8/8/07

Curriculum Vita

# W. James Steenburgh

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Professor and Chair
Department of Meteorology
University of Utah
135 South 1460 East, Room 819
Salt Lake City, UT 84112-0110
(801) 581-6136
http://www.met.utah.edu/people/faculty/department/jimsteenburgh/index_html
jim.steenburgh@utah.edu

## Research Interests

Mountain weather and climate, orographic and lake-effect precipitation, urban and arid-land meteorology, weather analysis and forecasting

## Professional Experience

| | |
|---|---|
| 2005 – present | Chair, Dept. of Meteorology, University of Utah |
| 2001 – present | Associate Professor, Dept. of Meteorology, University of Utah |
| 2002 | Visiting Professor, University at Albany, State University of New York |
| 2002 | Head, Mesoscale Modeling Group, 2002 Olympic Winter Games |
| 1995 – 2001 | Assistant Professor, Dept. of Meteorology, University of Utah |
| 1995 | Research Associate, Dept. of Atmospheric Sciences, University of Washington |
| 1989 – 1995 | Research Assistant, Dept. of Atmospheric Sciences, University of Washington |
| 1988 | Intern Meteorologist, National Weather Service, Albany, NY |

## Education

| | | |
|---|---|---|
| 1995 | Ph. D. | Atmospheric Sciences, University of Washington<br>Doctoral Thesis: "An Investigation of the Interaction of Extratropical Cyclones with the Complex Terrain of Western North America," C. F. Mass, advisor. |
| 1989 | B.S. | Meteorology, The Pennsylvania State University, with high distinction |

## Peer-Reviewed Publications

Shafer, J. C., and W. J. Steenburgh, 2007: Climatology of strong Intermountain cold fronts. *Mon. Wea. Rev.*, in review.

Cheng, W. Y. Y., and W. J. Steenburgh, 2007: Strengths and weaknesses of MOS, running-mean bias removal, and Kalman filter techniques for improving model forecasts over the western U. S. *Wea. Forecasting*, in press.

Orf, L., G. Lackman, C. Herbster, A. Krueger, E. Cutrim, T. Whitaker, J. Steenburgh, and M. Voss, 2007: Models as educational tools. *Bull. Amer. Meteor. Soc.*, **88**, 1101-1104.

West, G. L., W. J. Steenburgh, and W. Y.-Y. Cheng, 2007: Spurious grid-scale precipitation in the North American Regional Reanalysis. *Mon. Wea. Rev.*, **135**, 2168-2184.

Shafer, J. C., W. J. Steenburgh, J. A. W. Cox, and J. P. Monteverdi, 2006: Terrain influences on synoptic storm structure and mesoscale precipitation distribution during IPEX IOP3. *Mon. Wea. Rev.*, **134**, 478-497.

Cheng, W. Y. Y., and W. J. Steenburgh, 2005: Evaluation of surface sensible weather forecasts by the WRF and Eta models over the western United States. *Wea. Forecasting*, **20**, 812-821.

Colle, B. A., J. B. Wolfe, W. J. Steenburgh, D. E. Kingsmill, J. A. W. Cox, and J. C. Shafer, 2005: High resolution simulations and microphysical validation of an orographic precipitation event over the Wasatch Mountains during IPEX IOP3. *Mon. Wea. Rev.*, **133**, 2947-2971.

Hart, K. A., W. J. Steenburgh, and D. J. Onton, 2005: Model forecast improvements with decreased horizontal grid spacing over fine-scale Intermountain orography during the 2002 Olympic Winter Games. *Wea. Forecasting*, **20**, 558-576.

Cox, J. A. W., W. J. Steenburgh, D. E. Kingsmill, J. C. Shafer, B. A. Colle, O. Bousquet, B. F. Smull, and H. Cai, 2005: The kinematic structure of a Wasatch Mountain winter storm during IPEX IOP3. *Mon. Wea. Rev.*, **133**, 521-542.

Pataki, D. E., B. J. Tyler, R. E. Peterson, A. P. Nair, W. J. Steenburgh, and E. R. Pardyjak, 2005: Can carbon dioxide be used as a tracer of urban atmospheric transport? *J. Geophys. Res.*, **110**, D15, D15102.

Steenburgh, W. J., 2004: One hundred inches in one hundred hours – the complex evolution of an Intermountain winter storm cycle. *Bull. Amer. Meteor. Soc.*, **85**, 16-20.

Steenburgh, J., and E. Greene, 2004: Intermountain winter storm evolution during a 100-inch storm cycle. *The Avalanche Review*, **22(4)**, 13-16.

Hart, K. A., W. J. Steenburgh, D. J. Onton, and A. J. Siffert, 2004: An evaluation of mesoscale-model based model output statistics (MOS) during the 2002 Olympic and Paralympic Winter Games. *Wea. Forecasting*, **19**, 200-218.

Steenburgh, W. J., 2003: One hundred inches in one hundred hours – evolution of a Wasatch Mountain winter storm cycle. *Wea. Forecasting*, **18**, 1018-1036.

Steenburgh, W. J., 2002: Using real-time mesoscale modeling in undergraduate education. *Bull. Amer. Meteor. Soc.*, **83**, 1447-1451.

Horel, J., T. Potter, L. Dunn, W. J. Steenburgh, M. Eubank, M. Splitt, and D. J. Onton, 2002: Weather support for the 2002 Winter Olympic and Paralympic Games. *Bull. Amer. Meteor. Soc.*, **83**, 227-240.

Schultz, D. M., W. J. Steenburgh, R. J. Trapp, J. Horel, D. E. Kingsmill, L. B. Dunn, W. D. Rust, L. Cheng, A. Bansemer, J. Cox, J. Daugherty, D. P. Jorgensen, J. Meitin, L. Showell, B. F. Smull, K. Tarp, and M. Trainor, 2002: Understanding Utah Winter Storms: The Intermountain Precipitation Experiment. *Bull. Amer. Meteor. Soc.*, **83**, 189-210.

Stewart, J. Q., C. D. Whiteman, W. J. Steenburgh, and X. Bian, 2002: A climatological study of thermally driven wind systems of the U. S. Intermountain West. *Bull. Amer. Meteor. Soc.*, **83**, 699-708.

Steenburgh, W. J., and T. R. Blazek, 2001: Topographic distortion of a cold front over the Snake River Plain and central Idaho Mountains. *Wea. Forecasting*, **16**, 301-314.

Steenburgh, W. J., and D. J. Onton, 2001: Multiscale analysis of the 7 December 1998 Great Salt Lake-effect snowstorm. *Mon. Wea. Rev.*, **129**, 1296-1317.

Onton, D. J., and W. J. Steenburgh, 2001: Diagnostic and sensitivity studies of the 7 December 1998 Great Salt Lake-effect snowstorm. *Mon. Wea. Rev.* **129**, 1318-1338.

Steenburgh, W. J., S. F. Halvorson, and D. J. Onton, 2000: Climatology of lake-effect snowstorms of the Great Salt Lake. *Mon. Wea. Rev.,* **128**, 709-727.

Mass, C. F., and W. J. Steenburgh, 2000: An observational and numerical study of an orographically trapped wind reversal along the west coast of the U.S. *Mon. Wea. Rev.,* **128**, 2363-2396.

Schultz, D. M., and W. J. Steenburgh, 1999: The formation of a forward-tilting cold front with multiple cloud bands during Superstorm 1993. *Mon. Wea. Rev.*, **127**, 1108-1124.

White, B. G., J. Paegle, W. J. Steenburgh, J. D. Horel, R. T. Swanson, L. K. Cook, D. J. Onton, and J. G. Miles, 1999: Short-term forecast validation of six models. *Wea. Forecasting*, **14**, 84-108.

Steenburgh, W. J., D. M. Schultz, and B. A. Colle, 1998: The structure and evolution of gap outflow over the Gulf of Tehuantepec, Mexico. *Mon. Wea. Rev.*, **126**, 2673-2691.

Steenburgh, W. J., C. F. Mass, and S. A. Ferguson, 1997: The influence of terrain-induced circulations on wintertime temperature and snow level in the Washington Cascades. *Wea. Forecasting,* **12**, 208-227.

Steenburgh, W. J., and C. F. Mass, 1996: Interaction of an intense extratropical cyclone with the coastal orography of western North America. *Mon. Wea. Rev.,* **124**, 1329-1352.

Steenburgh, W. J., and C. F. Mass, 1994: The structure and evolution of a simulated Rocky Mountain lee trough. *Mon. Wea. Rev.*, **122**, 2740-2761.

Steenburgh, W. J., and J. R. Holton, 1993: On the interpretation of geopotential height tendency equations. *Mon. Wea. Rev.*, **121**, 2642-2645.

Mass, C. F., W. J. Steenburgh, and D. M. Schultz, 1991: Diurnal surface pressure variations over the continental U.S. and the influence of sea level reduction. *Mon. Wea. Rev.*, **119**, 2814-2830.

**E-Publications**

Steenburgh, W. J., 2004: Dynamics and microphysics of cool-season orographic storms. COMET Meteorological Education & Training (MetEd) Program Webcast. http://deved.meted.ucar.edu/norlat/orographic/index.htm.

**Technical Reports**

SHARE: Sierra Hydrometeorology and Atmospheric River Experiment Master Planning Document. SHARE Scientific Steering Committee. D. Kingsmill and S. Yuter, co-chairs.

Steenburgh, W. J., and D. J. Onton, 2001: Meteorological modeling for the 2002 particulate matter (PM10) State Implementation Plan for Salt Lake and Utah Counties. Report to the Utah Department of Environmental Quality, Division of Air Quality, 21 pp.

Steenburgh, W. J., 1998: Weather support at the 1998 Nagano Winter Olympics: Summary and Recommendations. Report to the Salt Lake Organizing Committee for the Olympic Winter Games of 2002.

MAP: Mesoscale Alpine Programme U. S. Overview Document 1996, National Science Foundation Field Program Proposal. R. Houze, J. Kuettner, and R. Smith, eds.

Steenburgh, W. J., and C. F. Mass, 1996: Synoptic and mesoscale circulations during high ozone episodes over western Washington: An evaluation of the Penn State/NCAR Mesoscale Model (MM5). Report to the Puget Sound Air Pollution Control Agency, 67 pp.

Steenburgh, W. J., and C. F. Mass, 1996: Numerical Simulations of the PM-10 Episode of 3-4 January 1995. Report to the Puget Sound Air Pollution Control Agency, 28 pp.

**Research and Educational Funding**

Current

*Mechanisms of Intermountain Cold Front Evolution* (PI), National Science Foundation, **$387.5K**, 1/07-12/09.

*Structure and Evolution of Intermountain Cyclones* (PI), National Science Foundation, **$344.3K**, 1/04-12/07.

Past

*NOAA Cooperative Institute for Regional Prediction: 2004-2007* (co-PI), NOAA, **$375.0K**, 7/04-6/07.

*Evaluation of NCEP Regional Reanalyses over Complex Terrain* (co-PI), NOAA, **$220.0K**, 7/04-6/07.

*Improving the Gridded Forecast Process Using Statistically Post-Processed Model Guidance Based on High-Density Mesonet Observations* (PI), University Corporation for Atmospheric Research/COMET, **$81.0K**, 6/04-11/06.

*Orographic Precipitation Processes over the Wasatch Mountains during IPEX* (PI), National Science Foundation, **$231.5K**, 1/01-12/03.

*Cooperative Institute for Regional Prediction Contribution to CSTAR* (co-PI), NOAA, **$375.0K**, 1/01-12/03.

*Planning Weather Support for the 2002 Winter Olympics* (co-PI), NOAA, **$588.7K**, 4/01-3/02.

*Regional Coupled Atmospheric/Land–Surface Modeling for GAPP* (PI), University of Utah Seed Grant Committee, **$30.7K**, 3/02-2/03.

*Cooperative Institute for Regional Prediction: 2000* (co-PI), NOAA, **$125.0K**, 1/00-12/00.

*Planning Weather Support for the 2002 Winter Olympics* (co-PI), NOAA, **$216.0K**, 1/99-12/ 99.

*Collaboration for Improved Meteorological Modeling* (PI), Utah Division of Air Quality, **$56.7K**. 10/99-9/01.

*Planning Weather Support for the 2002 Winter Olympics* (co-PI), NOAA, **$97.0K**, 6/98-6/99.

*Development of a Meteorological Computation and Visualization Laboratory: A Unidata Equipment Proposal* (PI), National Science Foundation, **$19.4K**, 9/97-9/98.

*Mesoscale Modeling Studies of Warm Season Rainfall in the PACS Domain* (co-PI), NOAA-OGP, **$171.7K**, 3/98-2/00.

*Observational and Numerical Investigations of the Interaction of Synoptic Weather Systems with the Orography of the Western United States* (PI), National Science Foundation, **$206.5K**, 2/97-1/00.

*Workshop on Weather Prediction in the Intermountain West* (PI), University Corporation for Atmospheric Research//COMET, **$3.8K**, 4/ 98-3/99.

*Real-Time Numerical Weather Prediction for the Wasatch Front and Adjoining Region* (PI), University of Utah Research Committee, **$5.8K**, 2/96-2/98.

**Field Program Participation**

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|---|---|
| IMPROVE (2001) | Lead forecaster |
| IPEX (2000) | Co-lead scientist, mission coordinator, lead forecaster |
| VTMX (2000) | Lead forecaster |
| COAST (1993) | Airborne scientist, field-phase forecasting and planning |

**Teaching**

I regularly teach a year-long sequence in synoptic meteorology covering synoptic-dynamic meteorology, extratropical cyclones and fronts, and weather analysis and forecasting. I have also co-developed an advanced course in Mountain Meteorology (Meteo 5550/6550) in collaboration with Dr. John Horel. In 2001 I received the *College of Mines and Earth Sciences Outstanding Teaching Award.* I also served as the Department Undergraduate Advisor from 1996-2005.

Synoptic Meteorology I (Meteo 5530/6530)
Synoptic Meteorology II (Meteo 5540/6540)
Mountain Meteorology (Meteo 5550/6540)
Mountain Weather and Climate (ATM 619, University at Albany, Fall 2002)
Fundamental Applications of Dynamic Meteorology (Meteo 551, quarter system)
Weather Discussion (Meteo 5580/6580)
Undergraduate Seminar (Meteo 2810)
Graduate Seminar (Meteo 7810)
Undergraduate Advisor (1996-2005)

**Student Mentoring**

Doctoral Students Supervised

Cox, J. A. W., 2006: The Sensitivity of thermally driven mountain flows to land-cover change. Present Employment: Research Meteorologist, AIR Worldwide, Boston, MA.

Shafer, J. C., 2005: Topographic and diabatic influences on baroclinic storm evolution over the Intermountain West. Present employment: Assistant Professor, Lyndon State College, VT.

Hart, K. A., 2004: An evaluation of high-resolution modeling and statistical forecast techniques over complex terrain. Present employment: Professor, U.S. Air Force Academy and Lt. Col., U.S. Air Force, Colorado Springs, CO.

Onton, D. J., 2000: An observational and numerical modeling investigation of Great Salt Lake-effect snow. Present employment: Meteorologist, National Weather Service.

Masters Students Supervised

West, G. L., 2005: Spurious grid-scale convection in the North American Regional Reanalysis (NARR). Present employment: Ph. D. student, University of Utah

Shafer, J. C., 2002: Synoptic and mesoscale structure of a Wasatch Mountain winter storm. Present employment: Assistant Professor, Lyndon State College, VT.

Cox, J. A. W., 2002: Kinematic structure of a Wasatch Mountain Snowstorm. Research Meteorologist, AIR Worldwide, Boston, MA.

Grandy, R. J., 2001: Case studies of ozone transport processes along the Wasatch Front. Present employment: Permit Engineer, State of Utah Division of Air Quality, UT.

Siffert, A. J., 2001: Point-specific MOS forecasts for the 2002 Winter Games. Present employment: Meteorologist, ACE-INA, Philadelphia, PA.

Blazek, T. R., 2000: Analysis of a Great Basin cyclone and attendant mesoscale features. Present employment: Major, U. S. Air Force, Offut AFB, NE.

Halvorson, S. F., 1999: Climatology of lake-effect snowstorms of the Great Salt Lake. Present employment: Meteorologist, U. S. Army Dugway Proving Grounds, UT.

Cook, L. K., 1998: An evaluation of mesoscale model performance over the western United States. Present employment: Meteorologist, National Weather Service, Salt Lake City, UT.

Current Research Assistants

Greg West, Ph. D.
Colby Neuman, M. S.

Graduate Committees

Erik Crosman, Ph.D. (enrolled)
Phoebe McNeally, Ph.D., Dept. of Geography (enrolled)
Scott Hynek, Ph. D., Dept. of Geology and Geophysics (enrolled)
Luis Blacutt, M.S. 2006
David Myrick, Ph.D. 2006
Mario Majcen, M.S. 2005
Eric Crosman, M.S. 2005
Eric Stone, M.S. 2004
Dan Zumpfe, M.S. 2004
Jennifer Roman, Ph.D. 2004
Robert Rice, Ph.D., Dept. of Civil Engineering, 2003
Linda Cheng, M.S. 2001
Gonzalo Miguez-Macho, Ph.D. 2000
Robert Swanson, Ph.D. 1998
Jonathan Slemmer, M.S. 1998
Brett McDonald, Ph.D. 1998
Bryan White, M.S. 1997
Christopher Stiff, M.S. 1997
Mark Braby, MS 1997

**Current and Past Undergraduate Research Assistants**

Eric Grimit
Jebb Stewart
Dave Strohm

Matt Maserik
Todd Foisy
Christine McCue
Marissa Orgill
Colby Neuman

**Invited Lectures and Seminars**

Steenburgh, W. J., 2006: *Everything you wanted to know about the Great Salt Lake effect but were afraid to ask*, Utah State University.

Steenburgh, W. J., 2005: *Improved performance measures for NWS gridded forecasts*, NWS-WR SOO/DOH Workshop.

Steenburgh, W. J., 2004: *Using the MesoWest cooperative networks for environmental analysis and prediction*, NOAA National Severe Storms Laboratory.

Steenburgh, W. J., 2004: *Mountains of snow: Orographic storms of the western United States*. American Avalanche Association Fall Weather Seminar, Snowbird, UT.

Steenburgh, W. J., 2003: *Dynamics and microphysics of orographic storms*, MSC/COMET Winter Weather Course.

Steenburgh, W. J., 2002: Numerical *weather prediction: The ultimate test of supercomputing*. University of Utah High School Computing Institute.

Steenburgh, W. J., 2002: *Weather support for the 2002 Olympic and Paralympic Winter Games*, Marine Sciences Research Center, State University of New York, Stony Brook.

Steenburgh, W. J., 2002: *ADAS, MesoWest, and IFPS challenges, tools, and strategies*, NWS-WR SOO/DOH Workshop.

Steenburgh, W. J., 2002: *Cool-season orographic precipitation processes and prediction*, MSC/COMET Winter Weather Course.

Steenburgh, W. J., 2001: *Weather research and forecasting advances for the 2002 Olympic Winter Games*, University of Innsbruck, Austria.

Steenburgh, W. J., 2000: *Educational applications of mesoscale modeling*, UCAR/UNIDATA Summer Workshop.

Steenburgh, W. J., 1999: *Orographic cyclogenesis*, UCAR/COMET Mesoscale Analysis and Prediction Course.

Steenburgh, W. J., 1997: *Mesoscale modeling over western North America: Model-aided studies and real-time applications*, UCAR/COMET Mesoscale Analysis and Prediction Course.

**Professional Service**

| | |
|---|---|
| 1996 – present | Fellow, NOAA Cooperative Institute for Regional Prediction |
| 2006 – present | 3TIER Environmental Forecast Group Science Advisory Board |
| 1994 – present | Member, American Meteorolgical Society |
| 2003 – 2006 | Chair, UCAR/Unidata User Committee |
| 2003 – 2006 | User Committee Representative, UCAR/Unidata Policy Committee |
| 1998 – 2006 | UCAR/Unidata User Committee |
| 2001 – 2006 | Associate Editor, *Weather and Forecasting* |
| 2005 | Utah Sci. Center Avalanche, Weather, Mountains and Risk Discussion Panel |
| 2004 | Chair, Workshop on Weather Prediction in the Intermountain West |
| 2000 – 2003 | AMS Mountain Meteorology Committee |

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|---|---|
| 1996 – 2002 | Head, Mesoscale Modeling Team for the 2002 Olympic Winter Games |
| 2002 | Co-chair (with Louisa Nance), AMS Mountain Meteorology Conference |
| 1999 – 2001 | PM10 SIP Modeling Workgroup, State of Utah Dept. of Environmental Quality |
| 2000 | Chair, Workshop on Weather Prediction in the Intermountain West |
| 1999 | Chair, Workshop on Weather Prediction in the Intermountain West |
| 1998 | Chair, Workshop on Weather Prediction in the Intermountain West |
| 1997 | Chair, Workshop on Weather Prediction in the Intermountain West |
| 1994 – 1996 | Manager, Workstation MM5 Users' Group |
| 1994 – 1996 | Advisory Committee for the PSU/NCAR Mesoscale Model |
| 1994 – 1996 | Puget Sound Regional Modeling Committee |

**University Service**

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|---|---|
| 2005 – present | Chair, Department of Meteorology |
| 2005 – present | College of Mines and Earth Sciences College Council |
| 2005 – present | College of Mines and Earth Sciences Executive and Space Committee |
| 2004 – 2006 | College of Mines and Earth Sciences Distinguished Lecture Series Committee |
| 1996 – 2005 | Department of Meteorology Undergraduate Advisor |
| 2003 – 2004 | Chair, College of Mines and Earth Sciences Faculty Relations Committee |
| 2001 – 2004 | Center for High Performance Computing Faculty Advisory Board |
| 1998 – 2004 | Department of Meteorology Curriculum Committee |
| 2001 – 2002 | Chiar, College of Mines and Earth Sciences Teaching Committee |
| 1996 – 2002 | College of Mines and Earth Sciences Teaching Committee |
| 1999 – 2001 | Chair, College of Mines and Earth Sciences Computer Committee |
| 1997 – 2001 | College of Mines and Earth Sciences Computer Committee |
| 2000 | College of Science Day Lecturer |
| 1999 | College of Science Day Lecturer |
| 1996 – 1998 | Leader, Department of Meteorology Semester Conversion |
| 1997 – 1998 | Academic Computing and Library Information Systems Advisory Committee |
| 1998 | Center for High Performance Computing Visualization Task Force |
| 1998 | College of Science Day Lecturer |
| 1997 | College of Science Day Lecturer |
| 1996 | College of Science Day Lecturer |
| 1996 | Featured Instructor, Commercials promoting use of technology in the classroom |

**Awards**

*Outstanding Service Award* (2002), National Weather Service Western Region, "for outstanding service to the weather support group for the 2002 Olympic Winter Games"

*Outstanding Teaching Award* (2001), College of Mines and Earth Sciences, University of Utah

*Graduate Fellowship* (1994), American Meteorological Society, to attend International Symposium on the Life Cycles of Extratropical Cyclones, Bergen, Norway

*Elizabeth Holmes Teas' Undergraduate Scholarship for Academic Excellence* (1987-1989)

Curriculum Vita

# David R. Bowling

8/15/07

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Assistant Professor
Department of Biology, University of Utah
257 S. 1400 E., Salt Lake City, UT 84112-0840
(801) 581-2130
bowling@biology.utah.edu

**Research Interests**

Ecosystem ecology, biosphere-atmosphere interactions, carbon and water cycling

**Academic Positions**

2003 – present Assistant Professor, Dept. of Biology, University of Utah
2006 – present Adjunct Assistant Professor, Dept. of Meteorology, University of Utah
2001 – 2002 Research Assistant Professor, Biology, University of Utah
1999 – 2001 Postdoctoral Scientist, Biology, U. of Utah, with J. Ehleringer

**Education**

| | | |
|---|---|---|
| 1999 | Ph.D. Biology | University of Colorado, Boulder, with R. Monson |
| 1994 | M.S. Electrical Engineering | University of Colorado, Boulder, with D. Etter |
| 1991 | B.S. Electrical Engineering | New Mexico State University |

**Peer-Reviewed Publications**

(graduate students underlined)
Number of times cited (published papers listed in Web of Science as of Aug. 2007)

- senior-authored papers: 304 times cited (avg 27.6/paper)
- co-authored papers: 232 times cited (avg 15.5/paper)

*in review*:

Zobitz JM, Moore D, Sacks WJ, Monson RK, Bowling DR, Schimel DS, Integration of process-based soil respiration models with whole-ecosystem $CO_2$ measurements, submitted 6/07 to *Ecosystems*.

Schaeffer SM, Anderson DE, Burns SP, Monson RK, Sun J, Bowling DR, Canopy structure and atmospheric flows in relation to the $\delta^{13}C$ of respired $CO_2$ in a subalpine coniferous forest, submitted 6/07 to *Agricultural and Forest Meteorology*.

Zobitz JM, Burns SP, Reichstein M, Bowling DR, Partitioning net ecosystem carbon exchange and the carbon isotopic disequilibrium between whole-ecosystem photosynthesis and respiration in a subalpine forest, submitted 5/07 to *Global Change Biology*.

Schwinning S, Bowling D, Ehleringer J, Belnap J, Sensitivity of the Colorado Plateau to change: climate, ecosystems, and society, submitted 5/07 to *BioScience*.

*in press:*

Zobitz JM, Burns SP, Ogee J, Reichstein M, Bowling DR, Partitioning net ecosystem exchange of $CO_2$ in a high-elevation subalpine forest: comparison of a

Bayesian/isotope approach to environmental regression methods, submitted 8/06 to *Journal of Geophysical Research.*

*published:*

32. Fuentes JD, Wang D, Bowling D, Potosnak M, Monson RK, Delany AC, Stockwell WR, Goliff WS (2007) Biogenic hydrocarbon chemistry within and above a mixed deciduous forest, *Journal of Atmospheric Chemistry.*, DOI 10.1007/s10874-006-9048-4.
31. Zobitz JM, Keener JP, Schnyder H, Bowling DR (2006) Sensitivity analysis and quantification of uncertainty for isotopic mixing relationships in carbon cycle research, *Agricultural and Forest Meteorology*, 136:56-75.
30. Wahl EH, and 12 others (2006) Applications of cavity ring-down spectroscopy to high precision isotope ratio measurement of $^{13}C/^{12}C$ in carbon dioxide, *Isotopes in Environmental and Health Studies*, 42:21-35, doi:10.1080/10256010500502934.
29. Pataki DE, Bowling DR, Ehleringer JR, Zobitz JM (2006) High resolution atmospheric monitoring of urban carbon dioxide sources, Geophys. Res. Lett., 33, L03813, doi:10.1029/2005GL024822.
28. Bowling DR, Burns SP, Conway T, Monson R, White JWC (2005) Extensive observations of $CO_2$ carbon isotope content in and above a high-elevation subalpine forest, *Global Biogeochemical Cycles*, 19, GB3023, doi:10.1029/2004GB002394.
27. Roden JS, Bowling DR, McDowell NG, Bond B, Ehleringer JR (2005) Carbon and oxygen isotope ratios of tree ring cellulose along a precipitation transect in Oregon, USA, *Journal of Geophysical Research*, 110, G02003, doi:10.1029/2005JG000033.
26. Baldocchi DD, and Bowling DR (2005) Theoretical examination of Keeling-plot relationships for carbon dioxide in a temperate broadleaved forest with a biophysical model, CANISOTOPE, in, Flanagan LB, Ehleringer JR, Pataki DE, Eds. *Stable Isotopes and Biosphere-Atmosphere Interactions: Processes and Biological Controls*, Elsevier, Amsterdam, pp 109-124.
25. McDowell NG, Bowling DR, Schauer A, Irvine J, Bond BJ, Law BE, Ehleringer JR (2004) Associations between carbon isotope ratios of ecosystem respiration, water availability and canopy conductance, *Global Change Biology*, 10, 1767–1784, doi: 10.1111/j.1365-2486.2004.00837.x
24. McDowell NG, Bowling DR, Bond BJ, Irvine J, Law BE, Anthoni P, Ehleringer JR (2004) Response of the carbon isotopic content of ecosystem, leaf and soil respiration to meteorological and physiological driving factors in a *Pinus ponderosa* ecosystem, *Global Biogeochemical Cycles,* 18, GB1013, doi:10.1029/2003GB002049.
22. Bowling DR, McDowell NG, Welker JM, Bond BJ, Law BE, Ehleringer JR (2003) Oxygen isotope content of $CO_2$ in nocturnal ecosystem respiration: 1: Observations in forests along a precipitation transect in Oregon, USA, *Global Biogeochemical Cycles*, 17(4), 1120, doi:10.1029/2003GB002081.
21. Bowling DR, McDowell NG, Welker JM, Bond BJ, Law BE, Ehleringer JR (2003) Oxygen isotope content of $CO_2$ in nocturnal ecosystem respiration: 2: Short-term dynamics of foliar and soil component fluxes in an old-growth ponderosa pine forest, *Global Biogeochemical Cycles*, 17(4), 1124, doi:10.1029/2003GB002082.
20. Pataki DE, Bowling DR, Ehleringer JR (2003) The seasonal cycle of carbon dioxide and its isotopic composition in an urban atmosphere: anthropogenic and biogenic effects, *Journal of Geophysical Research*, 108(D23), 4735, doi:10.1029/2003JD003865.

19. Bowling DR, Sargent SD, Tanner BD, and Ehleringer JR (2003) Tunable diode laser absorption spectroscopy for stable isotope studies of ecosystem-atmosphere $CO_2$ exchange, *Agricultural and Forest Meteorology*, 118, 1-19.
18. Schauer AJ, Lai C-T, Bowling DR, Ehleringer JR (2003) An automated sampler for collection of atmospheric trace gas samples for stable isotope analyses, *Agricultural and Forest Meteorology,* 118, 113-124.
17. Bowling DR, Pataki DE, and Ehleringer JR (2003), Critical evaluation of micrometeorological methods for measuring ecosystem-atmosphere isotopic exchange of $CO_2$, *Agricultural and Forest Meteorology*, 116, 159-179.
16. Pataki DE, Ehleringer JR, Flanagan LB, Yakir D, Bowling DR, Still CJ, Buchmann N, Kaplan JO, and Berry J (2003) The application and interpretation of Keeling plots in terrestrial carbon cycle research, *Global Biogeochemical Cycles*. 17(1), 1022, doi:10.1029/2001GB001850.
15. Baldocchi DD, and Bowling DR (2003) Modelling the discrimination of $^{13}CO_2$ above and within a temperate broad-leaved forest canopy on hourly to seasonal time scales, *Plant, Cell, and Environment*, 26:231-244.
14. Ehleringer JR, Bowling DR, Flanagan LB, Fessenden J, Helliker B, Martinelli LA, Ometto JP (2002) Stable isotopes and carbon cycle processes in forests and grasslands, *Plant Biology*, 4:181-189.
13. Bowling D, McDowell N, Bond B, Law B, and Ehleringer J (2002) $^{13}C$ content of ecosystem respiration is linked to precipitation and vapor pressure deficit, *Oecologia*, 131:113-124.
12. Bowling DR, Cook CS, and Ehleringer JR (2001) Technique to measure $CO_2$ mixing ratio in small flasks with a bellows/IRGA system, *Agricultural and Forest Meteorology,* 109, 61-65.
11. Bowling DR, Tans PP, and Monson RK (2001) Partitioning net ecosystem carbon exchange with isotopic fluxes of $CO_2$, *Global Change Biology*, 7:127-145.
10. Bowling DR, Baldocchi DD, and Monson RK (1999) Dynamics of isotopic exchange of carbon dioxide in a Tennessee deciduous forest, *Global Biogeochemical Cycles*, 13:903-922.
9. Bowling DR, Delany AC, Turnipseed AA, Baldocchi DD, and Monson RK (1999) Modification of the relaxed eddy accumulation technique to maximize measured scalar mixing ratio differences in updrafts and downdrafts, *Journal of Geophysical Research*, 104:9121-9133.
8. Baldocchi D, Fuentes J, Bowling D, Turnipseed A, and Monson R (1999) Scaling isoprene fluxes from leaves to canopies: test cases over a boreal aspen and a mixed species temperate forest, *Journal of Applied Meteorology*, 38:885-898.
7. Katul G, Hsieh C-I, Bowling D, Clark K, Shurpali N, Turnipseed A, Albertson J, Tu K, Hollinger D, Evans B, Offerle B, Anderson D, Ellsworth D, Vogel C, and Oren R (1999) Spatial variability of turbulent fluxes in the roughness sublayer of an even-aged pine forest, *Boundary-Layer Meteorology,* 93:1-28.
6. Singsaas E, Laporte M, Shi J, Monson R, Bowling D, Johnson K, Lerdau M, Jasentuliytana A, and Sharkey T. (1999) Kinetics of leaf temperature fluctuation affects isoprene emission from red oak (*Quercus rubra* L.) leaves, *Tree Physiology*, 19:917-924.
5. Bowling DR, Turnipseed AA, Delany AC, Baldocchi DD, Greenberg JP, and Monson RK (1998) The use of relaxed eddy accumulation to measure biosphere-atmosphere exchange of isoprene and other trace gases, *Oecologia*, 116:306-315.
4. Demmig-Adams B, Adams III WW, Barker DH, Logan BA, Bowling DR, and Verhoeven AS (1996) Using chlorophyll fluorescence to assess the fraction of

absorbed light allocated to thermal dissipation of excess excitation, *Physiologia Plantarum* 98:253-264.

*technical reports:*

23. American Institute of Biological Sciences. (2004) Ecological Aspects of Biogeochemical Cycles: Report from a NEON Science Workshop. Washington, DC: AIBS.
3. Durand S and Bowling D (1990) *Data Acquisition for Photovoltaic Power Plants*, EPRI Publication GS-7082, Electric Power Research Institute.
2. Durand S, Bowling D, and Risser V (1990) Lessons Learned From Testing Utility Connected PV Systems, *Proc. 21st IEEE PV Specialists Conference*, 909-913.
1. Rosenthal A, Lane C, and Bowling D (1990) *Photovoltaic System Performance Assessment for 1988*, EPRI Publication GS-6696, Electric Power Research Institute.

**Grant Support**

Present:

*Long-term assessment of isotopic exchange of carbon dioxide in a subalpine forest (Niwot Ridge AmeriFlux site)*, U. S. Department of Energy, DE-FG02-04ER63904, **$649.8k**, PI: Bowling, 9/04-9/07.

*Isotope Ratio Mass Spectrometers for Environmental Research*, NSF Major Research Instrumentation, **$405k**, PIs: Ehleringer, Cerling, Bowling, 7/07-6/09.

Past:

*Development of a novel real-time method to measure the stable isotope content of carbon dioxide respired from soil*, University of Utah Funding Incentive Seed Grant Program, **$27k**, PI: Bowling, 7/06-6/07.

*Field-deployable gas analyzer for MMV applications (Phase I)*, U. S. Department of Energy, SBIR program, PI: Anthony O'Keefe, Los Gatos Research, Bowling subcontract **$14.8k**, 2/07-3/07.

*Technical proposal for the development of a Fourier-transform infrared gas analyzer to measure carbon isotopes of $CO_2$*, U.S. Department of Energy, SBIR program, PI: Larry Jacobsen, Campbell Scientific, Inc., Bowling subcontract **$15.2k**, 8/05-7/06. (this grant was awarded but the company did not make enough progress to merit testing the instrument, so we never saw the money at Utah)

*System upgrade for Biology's shared tunable diode laser absorption spectrometer,* Research Instrumentation Fund Award, University of Utah, **$7.1k**, PI: Bowling, 7/05.

*Instrumentation purchase for a shared tunable diode laser absorption spectrometer*, Research Instrumentation Fund Award, University of Utah, **$77.6k**, PI: Bowling, 6/03.

*Ecosystem carbon cycling in a desert grassland*, University Research Committee Faculty Research and Creative Grant, University of Utah, **$5.4k**, PI: Bowling, 5/03-5/04.

*Ultra-sensitive portable isotope ratio analyzer*, US Department of Energy, SBIR DE-FG03-01ER83250-A002, PI: Dmitri Permogorov, Picarro, Inc., Bowling subcontract **$122k**, 5/02-5/04.

Pending:

*A Regional Atmospheric Continuous $CO_2$ Observing Network in the Rocky Mountains (Rocky RACCOON): Operation and Synthesis with Remote Sensing Products to Produce Regional Carbon Flux Estimates*, NASA Carbon Cycle Science, PI Britt Stephens, National Center for Atmospheric Research, Bowling subcontract **$168.3k**, 1/08-12/10.

*Field-deployable gas analyzer for MMV applications (Phase II)*, U. S. Department of Energy, SBIR program, PI: Anthony O'Keefe, Los Gatos Research, Bowling subcontract **$63.6k**, 1/08-1/09.

*Environmental controls on the isotopic content of plant, soil, and ecosystem respiration,* US Department of Energy Terrestrial Carbon Processes Program, **$721k**, PI: Bowling, 9/06-8/09 (still in review, very delayed by the agency)

Graduate student fellowships (I contributed as Ph.D. advisor):

*Comparison and assessment of methods to partition net ecosystem exchange of $CO_2$ in heterogeneous environments*, US Department of Energy Global Change Education Program, Graduate Research Environmental Fellowship, **$54k**, (2005-2008), (awarded to John Zobitz)

**Teaching**

Ecosystem Ecology (new course Fall 2004, Fall 2006, Biology 5490): This lecture course for 50-70 upper division or graduate students examines the biological, physical, and chemical factors that control storage and cycling of the major elements (carbon, nitrogen, and phosphorus) within terrestrial ecosystems.

Biophysical Ecology (new course Fall 2005, Fall 2007, Biology/Meteorology/Geology 5495): This lecture and laboratory course for 25 upper division or graduate students examine the physical environment in which plants, animals, and soil organisms live, how the physical environment affects their physiological function, and how organisms in turn affect their physical environment.

Water and Ecology of Western Ecosystems (new course Fall 2003, Biology 7406): This graduate core seminar examines the importance of water to animals, plants, insects, and microbes in ecosystems of the western U.S.

Biological Responses to Climate Change (new course Spring 2005, Biology 7406): This graduate core seminar examines observed responses of biological systems to climate change, such as increased growing season length, altered migration patterns, changes in species abundance, etc.

Stable Isotope Ecology (existing course, team-taught Summers 2003-2007, Biology 7473/7475): This summer 2-week course attracts top-notch graduate students, postdocs, and faculty from around the world. The course focuses on environmental science applications of stable isotope theory, methods, instrumentation, experimental design, lab and fieldwork.

**University Service**

University Committees

College of Science Representative to International Requirement Committee, since 8/05

Department of Biology Committees

2002-2003 Graduate Admission

2003-2004 Graduate Admission, Communication, BioURP Steering, Red Butte Canyon
2004-2005 Graduate Admission, BioURP Steering, Red Butte Canyon
2005-2006 Graduate Admission, Curriculum and Teaching, Red Butte Canyon, Riser Award
2006-2007 Graduate Admission, Curriculum and Teaching, Red Butte Canyon
2007-2008 pending

Science Overnight Orientation, Faculty Volunteer, 6/05 and 6/06

**Professional Service**

Associate Editor, Journal of Geophysical Research – Biogeosciences, since 12/04.

AmeriFlux Steering Committee member, which oversees a national flux tower $CO_2$ monitoring network, since 10/04.

Manuscript reviews:
Agricultural and Forest Meteorology, Analytical Chemistry, Applied Geochemistry, Applied Spectroscopy, Atmospheric Environment, Australian Journal of Plant Physiology, Chemical Geology, Ecological Applications, European Journal of Soil Biology, Geochimica et Cosmochimica Acta, Global Biogeochemical Cycles, Global Change Biology, Isotopes in Environmental and Health Studies, Journal of Applied Meteorology, Oecologia, Plant, Cell, and Environment, Tellus, Tree Physiology

Grant proposal review panels:
- NSF June 2007

Grant proposal reviews:
- NSF Directorate for Biological Sciences, Division of Environmental Biology
  - Ecosystem Science cluster
  - Instrumentation and Instrumentation Development
  - Major Research Instrumentation
- NSF Directorate for Geosciences, Division of Atmospheric Sciences
- USDOE National Institute for Global Environmental Change
  - Northeast Regional Center
  - Southeast Regional Center
  - Great Plains Regional Center
- USDOE National Institute for Climatic Change Research
  - Northeast Regional Center
  - Southeast Regional Center
- USDOE Small Business Innovation Research
- Kearney Foundation for Soil Science (U. California system)
- NOAA Climate and Global Change Program
- Natural Environment Research Council (United Kingdom)
- Israel Science Foundation (Israel)
- Swiss National Science Foundation (Switzerland)

External dissertation reviews:

- Australian National University, Research School of Biological Sciences (Australia)

Active in developmental meetings for National Ecological Observatory Network (NEON, http://www.neoninc.org/)

- Site evaluation visit to Onaqui-Benmore area in Utah for Great Basin Domain 15 Core Site, 4/07.
- Rocky Mountain Ecological Observatory Network (ROMEOnet) Regional Meetings, Ft. Collins, CO, 11/04, Boulder, CO, 4/04.
- Invited participant, NEON Workshop, Boulder, CO, 7/04 – co-authored an associated publication (in list above)

Active in developmental meetings for Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI, http://www.cuahsi.org/)

- collaboration on a vision paper regarding Watersheds and Urbanization
- development of the Great Salt Lake Basin as a Long-Term Hydrologic Observatory

Interaction with local media

- global change public discussion panel for KCPW radio, 6/16/06
- KCPW radio article, 3/16/06
- Newspaper article, Salt Lake Tribune, 8/7/06
- Newspaper article, Daily Utah Chronicle, 4/11/06
- Op-ed article, Daily Utah Chronicle, 9/17/04

**Students and Employees Supervised**

Graduate Students

- Primary PhD Advisor for:
  Seth Arens: beginning Fall 2007.
  Greg Maurer: beginning Fall 2007.
  Andrew Moyes: Expected to finish his Ph.D. sometime in 2008.
  John Zobitz: Awarded Ph.D. at end of summer 2007, accepted a tenure-track faculty position at Augsburg College.

- Served on Supervisory Committee for:
  - Biology: Susan Bush, Tomas Domingues, Sylvia Englund, Erin Hanlon, Anthony Macharia, Jessica Pearce, Christy Turnbull, Adam West
  - Mathematics: Molly Kelton
  - Geology and Geophysics: Mike Davis

Postdoctoral Scientists: Sean Schaeffer

Undergraduates: Susan Bush, Sarah Gaines, Zach James, Tina Jensen, Stephanie Plummer, Sarah Reed

Technicians: Suzanne Bethers, David Galvez, Shashi Kalaskar, Shannon Kincaid, Claire Lunch, Andy Schauer

**Invited Lectures and Seminars**

*international:*

Bowling D, Stable Isotopes of $CO_2$ and Forest Carbon Cycling, Wissenschaftszentrum Weihenstephan, Technische Universität München, Freising, Germany, 1/07.

Bowling D, Zobitz J, Burns S, Monson R, and Turnipseed A, Partitioning assimilation and respiration in a subalpine forest using isofluxes, International Symposium: "Partitioning of fluxes between the biosphere and atmosphere across spatial scales", ESF Scientific Programme, Stable Isotopes in Biospheric-Atmospheric Exchange (SIBAE), Interlaken, Switzerland, 4/04.

Bowling D, Burns S, Monson R, Turnipseed A, Photosynthetic and respiratory fluxes and their isotopic content in a Colorado subalpine forest, International Symposium: "Stable isotopic signals of the terrestrial biosphere: Linking ecosystem C fluxes to isotopic signals of plant components", ESF Scientific Programme, Stable Isotopes in Biospheric-Atmospheric Exchange (SIBAE), Orvieto, Italy, 11/03.

Bowling D, Partitioning NEE using ecosystem fluxes of $^{13}CO_2$, Fluxnet Synthesis Workshop, Orvieto, Italy, 06/02.

Bowling D, Lai C-T, McDowell N, Short-term environmental effects on $\delta^{13}C$ of ecosystem respiration, Stable Isotopes and Biosphere-Atmosphere Interactions International Workshop, Banff, Alberta, 5/02.

*within U.S.:*

Bowling D, Stable isotopes of $CO_2$ and forest carbon cycling, School of Biological Sciences, Washington State University, 2/07.

Bowling D, Stable isotopes of $CO_2$ and forest carbon cycling, Department of Ecology and Evolutionary Biology, University of Arizona, 4/06.

Bowling D, Stable isotopes and carbon exchange between terrestrial ecosystems and the atmosphere, American Society of Agronomy Annual Meeting, Salt Lake City, 11/05.

Bowling D, Stable isotopes and carbon exchange between terrestrial ecosystems and the atmosphere, Department of Geography, University of Utah, 4/05.

Bowling D, Partitioning net ecosystem carbon exchange with fluxes of $^{13}CO_2$, Department of Environmental Sciences, University of Virginia, 2/05.

Bowling D, The oxygen isotope composition of nocturnal ecosystem respiration, International Symposium: "Oxygen isotopes as a tracer linking global $O_2$, $CO_2$, and $H_2O$ cycles", Biosphere-Atmosphere Stable Isotope Network, Marshall, California, 9/04.

Bowling D, Stable isotopes and carbon exchange between terrestrial ecosystem and the atmosphere, Bowdoin College, Department of Biology. 2/04.

Bowling D, Yakir D, Interpreting ecosystem respiration fluxes using stable isotopes, in symposium "Respiratory control of the global C cycle in a changing environment", Ecological Society of America Annual Meeting, Savanna, GA, 8/03.

Bowling D, Stable isotopes of atmospheric $CO_2$ and ecosystem-scale biological processes, Columbia University's Biosphere2 Center, 10/01.

Bowling D, Partitioning Biosphere-Atmosphere Exchange of $CO_2$ into Photosynthesis and Respiration using Tower Measurements, University of Utah, Dept. of Geology and Geophysics, 9/01.

Bowling D,The Math Behind Eddy Covariance: Studying Biological Processes with Atmospheric Measurements, University of Utah, Mathematical Biology Seminar Series, 3/01.

Bowling D and Monson R, Forest-Atmosphere Fluxes of $^{13}CO_2$, American Geophysical Union Fall Meeting, San Francisco, CA, 12/99.

Bowling D, Flux measurement using relaxed eddy accumulation, AmeriFlux Network Annual Meeting, St. Louis, MO, 10/97.

**Other Lectures and Seminars**

(graduate students underlined)

Moyes AB, Bowling DR, Causes of seasonal and temporal variability in soil respiration along a Rocky Mountain riparian-meadow ecotone, Ecological Society of America annual meeting, San Jose, CA, 8/07.

Schaeffer SM, Monson RK, Burns SP, Bowling DR, Temporal and spatial effects on the isotopic composition of ecosystem-respired $CO_2$ in a high-elevation subalpine forest, Ecological Society of America annual meeting, San Jose, CA, 8/07.

Bowling DR, Schaeffer SS, Miller JM, Stephens B, $CO_2$ and $\delta^{13}C$ of $CO_2$ at three spatial scales over the Rocky Mountains, American Geophysical Union Fall Meeting, San Francisco, 12/06.

Moyes AB, Bowling DR, Seasonality of temperature, moisture, and substrate controls on soil carbon dioxide in a Rocky Mountain meadow, American Geophysical Union Fall Meeting, San Francisco, 12/06.

Schaeffer SM, Anderson DE, Burns SP, Monson RK, Sun J, Yi C, Bowling DR, Environmental controls on the stable isotopic composition of forest respired carbon dioxide across a vertical canopy profile in a subalpine coniferous forest, American Geophysical Union Fall Meeting, San Francisco, 12/06.

Zobitz JM, Ogee J, Monson RK, Bowling DR, High-resolution stable-isotope partitioning of net ecosystem exchange into respiration and photosynthesis, American Geophysical Union Fall Meeting, San Francisco, 12/05.

Pataki DE, Bowling DR, Ehleringer JR, Zobitz JM (presenter), High resolution atmospheric monitoring of urban carbon dioxide sources, US. Dept. of Energy Global Change Education Program Summer Orientation Workshop, Portland, Oregon, 6/06.

Roden JS, Bowling DR, Ehleringer JR, Stable oxygen and carbon isotope ratios of tree ring cellulose along a precipitation transect in Oregon, 2005 Annual Meeting of the American Society of Plant Biologists, 7/05.

Crosson E, Rella C, Richman B, Kachanov A, Wahl E, Tan S, Pham H, Koulikov S, Kharlamov B, Fidric B, Sanders S, Bowling D, and Paldus B, Applications of cavity ring-down spectroscopy to high precision isotope ratio: measurements of $^{12}C/^{13}C$ in carbon dioxide, SIRIS 2004, International Workshop on Stable Isotope Ratio Infrared Spectrometry: New Developments and Applications, Vienna, Austria, 9/04.

McDowell NG, Bowling D, Schauer A, Irvine J, Bond BJ, Law B, Ehleringer JR, Seasonal variation in the carbon isotope ratio of ecosystem respiration in two coniferous forests, American Geophysical Union Fall Meeting, San Francisco, CA, 12/03.

Baldocchi D, Bowling D, Interpreting carbon isotope ($^{13}CO_2$) fluxes and profiles over and under a temperate broadleaved forest with a biophysical model, *CANOAK*, Stable Isotopes and Biosphere-Atmosphere Interactions International Workshop, Banff, Alberta, 5/02.

Bowling DR, McDowell NG, Anthoni PM, Law BE, Bond BJ, and Ehleringer J, Isotopic ($^{13}C$) response of ponderosa pine ecosystem respiration to atmospheric stress events, American Geophysical Union Fall Meeting, San Francisco, CA, 12/01.

Baldocchi DD, and Bowling DR, Modeling carbon isotope fluxes and concentration profiles over a temperate deciduous forest across a spectrum of time scales with

a biophysical model, CANOAK, American Geophysical Union Fall Meeting, San Francisco, CA, 12/01.

McDowell NG, Bowling DR, Lunch CK, Welker J, Anthoni P, Law B, Bond BJ, and Ehleringer JR, Oxygen-18 content of ecosystem respiration across a climatic gradient in Oregon, American Geophysical Union Fall Meeting, San Francisco, CA, 12/01.

McDowell N, Bowling D, Bond B, and Ehleringer J, Seasonal variation of $\delta^{18}O$ of ecosystem respiration across a precipitation gradient in Oregon, USA, IUFRO Canopy Processes Workshop, 7/01.

Bowling D, McDowell N, Bond B, Anthoni P, Irvine J, Law B, and Ehleringer J, Seasonal and interannual variation in the carbon isotopic composition of ecosystem respiration along an Oregon precipitation gradient, American Geophysical Union Fall Meeting, San Francisco, CA, 12/00.

**Poster Presentations**

(graduate students and junior researchers underlined)

Ehleringer JR, Bramble D, Hultine K, Bowling D, Dearing MD, Entrada Field Station: a new opportunity for desert ecology and riparian ecology research in southeastern Utah, , Ecological Society of America annual meeting, San Jose, CA, 8/07.

Schaeffer S, Miller J, Stephens B, Bowling D, Carbon dioxide and $\delta^{13}C$ of $CO_2$ at multiple spatial scales over the Rocky Mountains, US North American Carbon Program Investigators Meeting, Colorado Springs, CO, 1/07.

Moyes AB, Bowling DR, Carbon dioxide, temperature, and moisture under a Rocky Mountain meadow, AmeriFlux Network annual meeting, Boulder, CO, 10/06.

Zobitz J, Bowling D, Adler F, Keener J, Dobson D, Estimating respiratory and photosynthetic fluxes in a heterogeneous conifer forest, IGERT Project Meeting, Washington DC, 5/05.

Zobitz JM, Keener JP, Bowling DR, Sensitivity analysis and quantification of uncertainty for isotopic mixing relationships in carbon cycle research, American Geophysical Union Fall Meeting, San Francisco, CA, 12/04.

Zobitz JM, Keener JP, Bowling DR, Analysis of Linear Regression Techniques to Determine $\delta^{18}O_R$ and $\delta^{13}C_R$: Implications and Applications, International Symposium: "Oxygen isotopes as a tracer linking global $O_2$, $CO_2$, and $H_2O$ cycles", Biosphere-Atmosphere Stable Isotope Network, Marshall, California, 9/04.

Pataki DE, Bush SE, Bowling DR, Ehleringer JR, Ecosystem respiration in an urban atmosphere: an isotopic approach, Carbon Respiration from Terrestrial Ecosystems: Reducing Uncertainties in the Role Played by Respiration in the Global Carbon Cycle (workshop), Laguna Beach, CA, 01/04.

Zobitz JM, Bowling DR, Process based belowground carbon dioxide modeling in a desert ecosystem, American Geophysical Union Fall Meeting, San Francisco, CA, 12/03.

Reed SE, Bond BJ, Bowling DR, McDowell NG, Ehleringer JR, Stable isotopic variation across a precipitation gradient in Oregon, DOE Global Change Education SURE Program, 8/03.

Lunch CK, Bowling DR, Difficulties of measuring eddy covariance fluxes of carbon dioxide at arid sites, Ecological Society of America Annual Meeting, Savanna GA, 8/03.

Bethers S, Bowling DR, Evapotranspiration of a semi-arid Utah grassland during the summer monsoon, Ecological Society of America Annual Meeting, Savanna GA, 8/03.

McDowell NG, Bowling D, Lunch CK, Welker J, Irvine J, Law BE, Bond BJ, Ehleringer JR, Relationships between precipitation, vapor pressure deficit, and $\delta^{18}O$ of ecosystem respiration across a steep climatic transect, Stable Isotopes and Biosphere-Atmosphere Interactions International Workshop, Banff, Alberta, 5/02.

McDowell N, Bowling D, Ecosystem respired $\delta^{18}O$ and $\delta^{13}C$: calculation via slopes vs. intercepts, Stable Isotopes and Biosphere-Atmosphere Interactions International Workshop, Banff, Alberta, 5/02.

Wever L, Flanagan LB, and Bowling DR, Seasonal and interannual variation in oxygen isotope discrimination in a temperate grassland ecosystem, American Geophysical Union Fall Meeting, San Francisco, CA, 12/01.

Pataki DE, Ehleringer JR, Flanagan LB, Yakir D, Bowling DR, Still C, Buchmann N, and Berry JA, The carbon isotope composition of ecosystem respiration in North and South America, American Geophysical Union Fall Meeting, San Francisco, CA, 12/01.

Bowling D, McDowell N, Bond B, Law B, and Ehleringer J, $^{13}C$ content of ecosystem respiration is linked to precipitation and vapor pressure deficit, International Union of Forestry Research Organizations (IUFRO) "Linking the Complexity of Forest Canopies to Ecosystem and Landscape Function" Workshop, 7/01.

Flanagan LB, Carlson PJ, Wever LA, and Bowling DR, Interannual variation in precipitation and its consequences for ecosystem carbon dioxide exchange and carbon isotope discrimination in a northern grassland, American Geophysical Union Fall Meeting, San Francisco, CA, 12/00.

*1999 ESA Best Student Poster in Physiological Ecology:*

Bowling D, Baldocchi D, and Monson R, Partitioning net ecosystem exchange in a Tennessee deciduous forest using stable isotopes of carbon dioxide, Ecological Society of America, Spokane, WA, 8/99.

Bowling D, Delany A, Turnipseed A, Baldocchi D, and Monson R, Modifying the REA technique to collect $CO_2$ for stable isotope analysis: hyperbolic relaxed eddy accumulation, FluxNet Conference, Polson, MT, 6/98.

Bowling D, Turnipseed A, Delany A, Baldocchi D, Greenberg J, and Monson R, Relaxed eddy accumulation of isoprene above a mixed deciduous forest, Ecological Society of America, Albuquerque, NM, 8/97.

Bowling D, Carbon cycling in a Colorado subalpine forest, EPA Star Graduate Conference, Raleigh-Durham, NC, 6/97.

# Timothy J. Garrett

## Education

University of Washington, Ph.D., Atmospheric Sciences, 2000 (*Advisor: P. V. Hobbs*)
University of Washington, M.S. Atmospheric Sciences, 1995 (*Advisor: P. V. Hobbs*).
University of Waterloo, B.Sc. Honours Physics, 1992

## Academic Positions

Assistant Professor, Meteorology Department, University of Utah, 2002 - present
Huber Fellow, Princeton Environmental Institute, Princeton University, 2000 - 2002

## Refereed Publications

Zhao, C. and **T. J. Garrett**, 2007: Ground-based remote-sensing of low-level cloud properties in the Arctic. *J. Geophys. Res.*, (submitted)

Zhao, C. and **T. J. Garrett**, 2007: Ground-based remote-sensing of precipitation in the Arctic. *J. Geophys. Res.*, (submitted)

Schultz, D.M., K.M. Kanak, J.M. Straka, A.J. Durant, and **T. J. Garrett,** 2007: Reply. *J. Atmos. Sci.* (accepted)

**Garrett, T. J.** Observational quantification of the optical properties of cirrus cloud. Chapter in *Light Scattering Reviews, Vol. 3,* A. Kokhanovsky, ed. (accepted), 2007

Liu, C., E. Zipser, **T. J. Garrett**, J. Jiang, and H. Su, 2007: How do the water vapor and carbon monoxide "tape recorders" start near the tropical tropopause? *Geophys. Res. Lett.*, 34, L09804, doi:10.1029/2006GL029234, 2007

**Garrett, T. J**. and L. Verzella, 2007: Hazy perspectives of Early Arctic Explorers. *Bull. Amer. Meteorol. Soc.* (in review)

**Garrett, T. J.**, M. B. Kimball, G. G. Mace, D. G. Baumgardner, 2007: Observing cirrus halos to constrain in-situ measurements of ice crystal size *Atmos. Chem. Phys. Discuss,* **7,** 1295-1325

Noel, V., D. M. Winker, **T. J. Garrett**, and M. McGill, 2007: Extinction coefficients retrieved in deep tropical ice clouds from lidar observations using a CALIPSO-like algorithm compared to in-situ measurements from the Cloud Integrated Nephelometer during CRYSTAL-FACE. *Atmos. Chem. Phys.* **7,** 1415-1422

**T. J. Garrett**, 2007: Comments on "Effective radius of ice cloud particle populations derived from aircraft probes" *J. Atmos. Oceanic. Technol.* **24,** 1492-1503.

Avey, L., **T. J. Garrett**, A. Stohl, 2007: Evaluation of the aerosol indirect effect using satellite, tracer transport model, and aircraft data from ICARTT, *J. Geophys. Res.* 112, D10S33, doi:10.1029/2006JD007581

**Garrett, T. J.**, L. Avey, P. I. Palmer, A. Stohl, J. A. Neuman, C. A. Brock, T. B. Ryerson, and J. S. Holloway, 2006: Quantifying wet scavenging processes in aircraft observations of Nitric Acid and CCN. *J. Geophys. Res.* 111, D23S51, doi:10.1029/2006JD007416

**Garrett, T. J.**, M. A. Zulauf, and S. K. Krueger, 2006: Effects of cirrus near the tropopause on anvil cirrus dynamics, *Geophys. Res. Lett,* 33, L17804, doi:10.1029/2006GL027071

**Garrett, T. J.** and C. Zhao, 2006: Increased Arctic cloud longwave emissivity associated with pollution from mid-latitudes. *Nature,* 440, 10.1038/nature04636, 787-789

**Garrett, T. J.**, J. Dean-Day, C. Liu, B. K. Barnett, G. G. Mace, D. B. Baumgardner, C. R. Webster, T. P. Bui, W. B. Read, and P. Minnis 2006: Convective formation of pileus cloud near the tropopause *Atmos. Chem. Phys.* **6,** 1185-1200

Schultz, D. M., K. M. Kanak, J. M. Straka, R. J. Trapp, B. A. Gordon, D. S. Zrnic, G. H. Bryan, A. J. Durant, **T. J. Garrett**, P. M. Klein, and D. K. Lilly, 2006: The mysteries of mammatus clouds: Observations and formation mechanisms. *J. Atmos. Sci.*, **63,** 2409-2435.

**Garrett, T. J.**, B. C. Navarro, C. H. Twohy, E. J. Jensen, D. G. Baumgardner, T. P Bui, H. Gerber, R. L. Herman, A. J. Heymsfield, P. Lawson, P. Minnis, L. Nguyen, M. Poellot, S. K. Pope, F. P. J. Valero, and E. Weinstock 2005: Evolution of a Florida cirrus anvil, *J. Atmos. Sci.,* **62,** 2352-2372.

Roskovensky, J. K., K.-N. Liou, **T. J. Garrett**, D. G., Baumgardner, 2004: Simultaneous Retrieval of Aerosol and Thin Cirrus Optical Depths using MODIS Airborne Simulator Data during CRYSTAL-FACE and CLAMS. *Geophys. Res. Lett.* Vol. **31,** No. 18, 10.1029/2004GL020457

**Garrett T. J.,** A. J. Heymsfield, B. A. Ridley, M. J. McGill, D. G. Baumgardner, T. P. Bui, and C. R. Webster, 2004: Convective generation of cirrus near the tropopause, *J. Geophys. Res.*, **109,** D21203, doi:10.1029/2004JD004952

**Garrett, T. J.,** C. Zhao, X. Dong, G. G. Mace, P. V. Hobbs, 2004: Effects of Varying Aerosol Regimes on Low-Level Arctic Stratus. *Geophys. Res. Lett.* Vol. 31, No. 17, 10.1029/2004GL019928

P. J. Popp, R. S. Gao, T. P. Marcy, D. W. Fahey, P. K. Hudson, T. L. Thompson, B. Karcher, R. L. Herman, B. A. Ridley, A. J. Weinheimer, D. J. Knapp, D. D. Montzka, D. G. Baumgardner, **T. J. Garrett,** E. M. Weinstock, J. G. Smith, D. S. Sayres, J. V. Pittman, S, Dhaniyala, P. T. Bui, and M. J. Mahoney, 2004: Nitric acid uptake on subtropical cirrus cloud particles. *J. Geophys. Res.* **109,** D06302, doi: 10.1029/2003JD004255

Gao, R. S., P. J. Popp, D. W. Fahey, T. P. Marcy, R. L. Herman, E. M. Weinstock, D. G. Baumgardner, **T. J. Garrett,** K. H. Rosenlof, T. L. Thompson, P. T. Bui, B. A. Ridley, S. C. Wofsey, O. B. Toon, M. A. Tolbert, B. Karcher, Th. Peter, P. K. Hudson, A. J. Weinheimer, and A. J. Heymsfield, 2004: Evidence that Nitric Acid increases relative humidity in low-temperature cirrus clouds. *Science,* **303,** 516-520.

**Garrett, T. J.**, H. Gerber, D. G. Baumgardner, D. G., C. H. Twohy, and E. M. Weinstock, 2003: Small, highly reflective ice crystals in low-latitude cirrus. *Geophys. Res. Let.,* **30,** 2132, doi:10.1029/2003GL018153.

**Garrett, T.J.** L.M. Russell, V. Ramaswamy, S.M. Maria, and B. Huebert, 2003: Microphysical and radiative evolution of aerosol plumes over the tropical North Atlantic Ocean. *J. Geophys. Res.,* **108 (D1),** 4022, doi:10.1029/2002JD002228.

**Garrett, T.J.**, L.F. Radke, and P.V. Hobbs, 2002: Aerosol effects on cloud emissivity and surface longwave heating in the Arctic, *J. Atmos. Sci.,* **59,** 769-778.

**Garrett, T.J.**, P.V. Hobbs, and L.R. Radke, 2002: High aitken nucleus concentrations above cloud tops in the Arctic, *J. Atmos. Sci.,* **59,** 779-783.

Wendisch, M., **T. J. Garrett,** and W. Strapp, 2002: PVM-100A liquid water content probe response to large droplets. *J. Atmos. Ocean. Tech.,* **19,** 1577-1584.

**Garrett, T.J.**, P.V. Hobbs, and H. Gerber, 2001: Shortwave, single-scattering properties of arctic ice clouds, *J. Geophys. Res.*, **106,** 15,155-15,172.

Curry, J. A, P. V. Hobbs, M. D. King, D. A. Randall, P. Minnis, G. A. Isaac, J. O. Pinto, T. Uttal, A. Bucholtz, D. G. Cripe, H. Gerber, C. W. Fairall, **T. J. Garrett,** J. Hudson, J. M., Intrieri, C. Jakob, T. Jensen, P. Lawson, D. Marcotte, L. Nguyen, P. Pilewskie, A. Rangno, D. C. Rogers, K. B Strawbridge, F. P. J. Valero, A. G. Williams, D. Wylie, 2000: FIRE Arctic Clouds Experiment. *Bull. Amer. Meteor. Soc.,* **81,** 5-29.

Durkee, P. and co authors, 2000: The impact of ship-produced aerosols on the microstructure and albedo of warm marine stratocumulus clouds: A test of MAST hypotheses 1i and 1ii. *J. Atmos. Sci.,* **57,** 2554-2569.

Ferek, R.J., **T.J. Garrett** and co-authors, 2000: Drizzle suppression in ship tracks. *J. Atmos. Sci.,* **57,** 2707-2728.

Hobbs, P.V., **T.J. Garrett**, and co-authors, 2000: Emissions from ships with respect to their effects on clouds, *J. Atmos. Sci.,* **57,** 2570-2590.

Hudson, J.G., **T.J. Garrett,** P.V. Hobbs, S.R. Strader, Y. Xie, and S.S. Yum, 2000: Cloud condensation nuclei and ship tracks. *J. Atmos. Sci.,* **57,** 2696-2706.

Noone K. J., D. W. Johnson, J. P. Taylor, R. J. Ferek, **T. Garrett,** P. V. Hobbs, P. A. Durkee, K. Nielsen, E. Öström, C. O'Dowd, M. H. Smith, L. M. Russell, R. C. Flagan, J. H. Seinfeld, L. De Bock, R. E. Van Grieken, J. G. Hudson, I. Brooks, R. F. Gasparovic, and R. A. Pockalny, 2000: A Case Study of Ship Track Formation in a Polluted Marine Boundary Layer. *J. Atmos. Sci.,* **57,** 2748-2764.

Noone, K. J., D. W. Johnson, J. P., Taylor, R. J. Ferek, **T. Garrett,** P. V. Hobbs, P. A. Durkee, K. Nielsen, E. Oestrom, C. O'Dowd, M. H. Smith, L. M. Russell, R. C. Flagan, J. H. Seinfeld, L. DeBock, R. E. Van Grieken, J. G. Hudson, I. Brooks, R. F. Gasparovic, I. Brooks, 2000: A case of ships forming and not forming tracks in moderately polluted clouds, *J. Atmos. Sci.,* **57,** 2729-2747.

Gerber, H., Y. Takano, **T. J. Garrett,** and P. V. Hobbs, 2000: Nephelometer measurements of the asymmetry parameter, volume extinction coefficient, and backscatter ratio in clouds. *J. Atmos. Sci.,* **57,** 3021-3034.

**Garrett, T.J.** and P.V. Hobbs, 1995: Long-range transport of continental aerosols over the Atlantic Ocean and their effects on cloud structures. *J. Atmos. Sci.,* **52,** 2977-2984.

## Other Publications

Kimball, M. B. and **T. J. Garrett,** *Constraining cirrus ice crystal size through observation of halos.* 12th Conference on Cloud Physics and Radiation, Madison, Wisconsin, 2006

Avey, L., **T. J. Garrett,** and A. Stohl, *Evaluation of the aerosol indirect effect using satellite, chemical transport model, and aircraft data from ICARTT,* 12th Conference on Cloud Physics and Radiation, Madison, Wisconsin, 2006

Zhao, C. and **T. J. Garrett**, *Ground-based retrieval of seasonal cloud an precipitation properties in the Arctic,* 12th Conference on Cloud Physics and Radiation, Madison, Wisconsin, 2006

**Garrett, T. J.,** H. Gerber, D. G. Baumgardner, M. Poellot, C. H. Twohy, and E. M. Weinstock, *Microphysical relationships in CRYSTAL-FACE anvil cirrus*. International Conference on Clouds and Precipitation, Bologna, Italy, 2004

**Garrett, T. J.,** X. Dong, G. G. Mace, C. Zhao: *Effects of arctic haze on clouds and the surface radiation balance*. Seventh Conf. on Polar Meteorology and Oceanography and Joint Symposium on High Latitude Climate Variations, , Hyannis Mass.,16-23 May 2003.

**Garrett, T. J.**: *Radiative Properties of Arctic Clouds*. Ph. D. Dissertation, University of Washington, 2000.

**Garrett, T. J.** and P. V. Hobbs, 1999: *Calibration of liquid water probes form the University of Washington's CV-580 aircraft at the Canadian NRC wind tunnel.*

**Garrett, T. J.** in collaboration with the Curriculum Development Unit of Tonga: *Form 3: Weather and the Sea.* Ministry of Education, Kingdom of Tonga, 1997.

**Garrett, T. J.**: *Ship Tracks: An Example of Aerosol-Cloud Interactions.* Masters Thesis, University of Washington, 1995.

## Recent Invited Presentations

*Is Arctic sea-ice melting stimulated by aerosol-cloud-radiative interactions?* Gordon Conference on Radiation and Climate, July, 2007.

*Is the Cloud System Homeostatic?* Dalhousie University, Canada, May, 2007

*Arctic Haze and Winter Warming* Arctic Climate Workshop sponsored by Clean Air Task Force, NASA GISS, January, 2007

*Pollution and the Arctic: 200 years of Man-Made Climate Change,* Wallace Stegner Center, University of Utah, October 2006

*Exploring Pollution-Cloud-Climate Interactions in the Arctic,* State University of New York, September 2006

*Exploring Pollution-Cloud-Climate Interactions in the Arctic,* Brookhaven National Laboratories, September 2006

# Teaching

## Courses

**Undergraduate** *Physical Meteorology*, *Meteorological Analysis*

**Graduate** *Radiative Transfer and Climate*; *Advanced Cloud Physics*; *Physical Meteorology*

## Graduate Students Advised

Bradley Navarro. M. S. 2003
Nathaniel Mullins M. S. 2005
Margaret Kimball M. S. 2006
Lance Avey M. S. 2006
Chuanfeng Zhao Ph. D. 2007
Stina Söström, M. S. Uppsala University, 2007
Kyle Tietze, 2007 - present
Clint Schmidt, 2007 - present

## Graduate Student Committees

Eric Vernon, M.S., 2002
Yuying Zhang M.S., 2002
Yaping Li, M.S. 2002
Haiyan Jiang, Ph.D. 2004

Kristen Dowd, M. S. 2004
Yuying Zhang, Ph. D. 2006
Ryan Riveland, M. S. 2006
Helena Schlueter, M. S. 2006
Daniel Hartsock, M.S. 2006
Jennifer Esker, M. S. 2006
Scott Robertson, M. S. 2007

# Service

Editor, 2007, - *Atmospheric Chemistry and Physics*
Associate Editor, 2003-2007, *Journal of Atmospheric Sciences*
Panel Review Committee for NOAA Office of Global Programs, October, 2004
Journal article reviewer for AMS, AGU, EGU and IEEE journals, *Nature* and Science
*Proposal* reviewer for NASA, NSF, DOE, and NOAA
Member ISDAC Science Team (2006-present)

# Awards

## Honors

*New Investigator Award,* NASA, 2006
*Huber Fellowship,* Princeton Environmental Institute, Princeton University, 2000 - 2002
*Atmospheric Chemistry Colloquium for Emerging Senior Scientists* (ACCESS), Invited participant, 2002
*Outstanding Student Paper Award,* AGU Fall Meeting, 1999

## Externally Awarded Research Proposals

**(Total $1,683,644)**

1. **NASA** *Optical Properties of Tropical Cirrus Clouds.* P. I. T. J. Garrett, Co-P.I. H. Gerber. $136,389. 01/2002 - 01/2004.

2. **NSF** *Aerosol-Cloud-Radiation Interactions in the Arctic.* P.I. T. Garrett, co-P.I. Xiquan Dong, Gerald G. Mace. $339,503. 04/2003 - 04/2006.

3. **NSF** *New Approaches for the Measurement of Microphysics in Extratropical Hurricanes.* P.I. T. J. Garrett. $19,946, 07/2003 - 07/2004.

4. **NOAA** 2003 *Aerosol-cloud-climate interactions downwind of North Eastern North America.* P.I. T. J. Garrett. $351,234. 03/03 - 03/06.

5. **NASA** *Airborne Studies of Middle and Low-Latitude Cirrus.* P. I. T. J. Garrett. $86,882. 01/04-01/05.

6. **NSF** *Formation and evolution of pileus cloud near the tropopause.* P. I. T. J. Garrett $35,693. 1/1/06 - 12/31/06.

7. **NASA** (New Investigator Program Award) *Interaction between microphysics, radiation and dynamics in terrestrial cirrus.* P. I. T. J. Garrett $339,976. 8/1/06 - 7/31/09.

8. **NSF** *Evaluation of Aerosol-Cloud-Radiation Processes and Feedbacks in the Alaskan Arctic.* P.I. T. J. Garrett $324,121 6/1/07-5/30/10.

9. **Clean Air Task Force** *Quantifying the significance of mid-latitude pollution plumes to clouds and sea-ice melting in the Arctic,* $50,000 6/1/07-5/30/08.

## Field Work

**NASA CRYSTAL-FACE**, Summer 2002: Integrated Cloud Integrating Nephelometer (CIN) onto the NASA WB-57 aircraft for the study of Florida anvil cirrus.
**CNRC ETHEX**, Fall, 2003: Integrated CIN onto Canadian National Research Council CV-580 Airborne Facility for flight into mid-latitude Hurricane systems.
**NASA MidCiX**, Spring, 2004: Integrated CIN onto the the NASA WB-57 for the study of mid-latitude and sub-tropical anvil cirrus.
**NOAA ICARTT**, Summer, 2004: Integrated CIN, FSSP-100 and OAP 2D-C onto NOAA and CNRC aircraft for the study of the effects of North American pollution on cloud radiative properties.

## Professional Memberships

American Meteorological Society. 2000 - present
American Geophysical Union 1998 - present

# Curriculum Vitae

## Robert Robertson Gillies

### ADDRESS

**Dr. Robert R. Gillies**
Director / State Climatologist (Utah)
Associate Professor
Utah State University
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### EDUCATION

M.A. with Honors (Geography; 2:1), University of Glasgow, U.K. (1984)
*(Advisor: A. Morrison)*
M.S. (Meteorology), The Pennsylvania State University
*(Advisor: T.N. Carlson).*
*Course Requirement Ph.D.*
Ph.D. (Meteorology and Remote Sensing), University of Newcastle, U.K. (1994)
*(Advisor: T.N. Carlson, The Pennsylvania State University)*

### ACADEMIC AND PROFESSIONAL EXPERIENCE

| | |
|---|---|
| 2006 – Present | Director of the Utah Climate Center / State Climatologist (Utah), Associate Professor, Utah Climate Center (Dept. Plants, Soils and Climate), Utah State University |
| 2002 - 2006 | Associate Professor (tenured) Departments of Watershed Sciences, Plants, Soils and Climate, Utah State University |
| 1996 - 2002 | Assistant Professor Departments of Geography and Earth Resources & Plants, Soils and Biometeorology, Utah State University |
| 1990 - 1996 | Research Associate / Support Scientist Earth System Science Center and Department of Meteorology, The Pennsylvania State University |
| 1987 - 1990 | Research Associate and Teaching Assistant, Collaborative Position The School of Architecture, University of Newcastle and Department of Meteorology, The Pennsylvania State University |
| 1987 | Scientific Programmer Department of Meteorology, The Pennsylvania State University |
| 1985 - 1987 | Research Associate, Building Science, The School of Architecture, University of Newcastle, U.K. |

1982 - 1983 President, University of Glasgow Athletic Club, U.K.

## PUBLICATIONS

*Peer-Reviewed*:

Carlson, T.N., Belles, J.E and **Gillies, R.R**.., 1991: Transient water stress in a vegetation canopy; simulations and measurements. *Remote Sensing of the Environment*., **35**, 175-186.

Carlson, T.N., **Gillies. R. R** and Perry, E.M., 1993: A method to make use of thermal infrared temperature and NDVI measurements to infer surface soil water content and fractional vegetation cover. *Remote Sensing Reviews.*, **52**, 45-59. Special Issue on Recent Advances in Remote Sensing Science.

**Gillies, R.R.** and Carlson, T.N., 1994: A physically based modeling approach for including remotely derived measurements in the study of land use change. *In Effects of Human-Induced Changes on Hydrological Systems, for American Water Resources Association, Annual Summer Symposium*, Technical Publication Series (TPS-94-3), (Bethesda, Maryland: American Water Resources Association) pp. 27-34.

Carlson, T.N., **Gillies R.R.** and Schmugge T.J., 1995: An interpretation of NDVI and radiant surface temperature as measures of surface soil water content and fractional vegetation cover. *Agricultural and Forest Meteorology*., 77, 191-205.

Carlson, T.N., Capehart, W.J. and **Gillies, R.R.**, 1995: A new look at the simplified method for remote sensing of daily evapotranspiration. *Remote Sensing of the Environment*., **54**, 161-167.

Carlson, T.N., Taconet, O., Vidal, A., **Gillies, R.R.**, Olioso, A. and Humes, K., 1995: An overview of the workshop on thermal remote sensing held at La Londe les Maures, France, September 20-24, 1993. *Remote Sensing Reviews,*. **12**, 147-158.

Carlson, T.N., Taconet, O., Vidal, A., **Gillies, R.R.**, Olioso, A. and Humes, K., 1995: An overview of the workshop on thermal remote sensing held at La Londe les Maures, France, September 20-24, 1993 *Agricultural and Forest Meteorology*., **77**, 141-151.

**Gillies, R.R.** and Carlson, T.N., 1995: Thermal remote sensing of surface soil water content with partial vegetation cover for incorporation into climate models. *Journal of Applied Meteorology.*, **34**, 745-756.

**Gillies, R.R.,** Cui, J., Carlson, T.N., Kustas, W.P., and Humes, K.S., 1997: Verification of a method for obtaining surface soil water content and energy fluxes from remote measurements of NDVI and surface radiant temperature. *International Journal of Remote Sensing.*, **18**, 3145-3166.

Owen, T.W., Carlson, T.N. and **Gillies, R.R.**, 1998: An assessment of satellite remotely sensed land cover parameters in quantitatively describing the climate effect of urbanization. *International Journal of Remote Sensing.*, **19**, 1663-1681.

Crombie, M.K., **Gillies R.R.**, Arvidson R.E., Brookmeyer P., Weil G.J., Sultan M., and Harb M. 1999: An application of remotely derived climatological fields for risk assessment of

vector-borne diseases – A spatial study of filariasis prevalence in the Nile delta, Egypt. *Photogrammetric Engineering and Remote Sensing*., **65**, 1401-1409.

Brunsell, N., **Gillies, R.R**. 2000 The effect of emissivity on evaporation. Remote Sensing and Hydrology 2000 (Proceedings of a symposium held at Santa Fe, New Mexico, USA, April 2000). IAHS Publ. No **267**, 2001, 276-280.

Gottschalk, J., **Gillies, R.R.** and Carlson T.N. 2001: The simulation of canopy transpiration under doubled $CO_2$: The evidence and impact of negative feedbacks on transpiration in two 1-D soil-vegetation-atmosphere-transfer (SVAT) models. *Agricultural and Forest Meteorology*., **106**, 1-21.

Gottschalk, J. and **Gillies, R.R.** 2001: Implications of feedback processes in plant water usage and resulting climate change. *Journal of the American Water Resources Association*., **37**, 305-314.

Brunsell, N., **Gillies, R.R.** 2002. Incorporating surface emissivity into a thermal atmospheric correction. *Photogrammetric Engineering and Remote Sensing*., **68** (12): 1263-1269.

Brunsell, N., **Gillies, R. R**. 2003: Determination of scaling characteristics of AVHRR data with wavelets: application to SGP97. *International Journal of Remote Sensing*, **24** (14), 2945-2957.

Brunsell, N., **Gillies, R.R**. 2003. Scale issues in land-atmosphere interactions: implications for remote sensing of the surface energy balance. *Agricultural and Forest Meteorology*., **117**, 203-221.

Brunsell, N., **Gillies, R.R**. 2003. Length scale analysis of surface energy fluxes derived from remote sensing. *Journal of Hydrometeorology*. **4**, 1212-1219.

**Gillies, R.R**., Brim-Box, J., Symanzik, J. and E.J. Rodemaker. 2003. Effects of urbanization on the aquatic fauna of the Line Creek watershed, Atlanta – A satellite perspective., *Remote Sensing of the Environment*, **86**, 441-422.

Rieke Arentsen, **Gillies, R.R** and Mesner, N. 2004: Satellite derived impervious surface area as an indicator for water resource impacts in a semi-arid environment, Utah, USA. In Management Information Systems 2004: Incorporating GIS and Remote Sensing, WIT Press. ISBN: 1-85312-728-0

Y.-J. Sun, J.-F Wang, R-H.Zhang, **R. R. Gillies**, Y-Xue, and Y-C. Bo. 2005: Air temperature retrieval from remote sensing data based on thermodynamics. Theoretical and Applied Climatology, **80**, 37-48.

*Book Chapters*

Chapter (*Coupling Thermal Infrared and Visible Satellite Measurements to Infer Biophysical Variables at the Land Surface*) in "Thermal Infrared Remote Sensing and Land Surface Processes". Dale A. Quattrochi, Jeffery C. Luvall (Eds). Taylor & Francis, ISBN 0415302242. January 2004

Book Chapter Co-author – (*Documenting Dynamics of Human Dynamics*) in "The Manual of Remote Sensing, 3rd Edition (A Series): Volume 5: Remote Sensing of Human

Settlements", Andrew B. Rencz, Editor-in-Chief; Volume Editors: Merrill K. Ridd & James D. Hipple. ISBN 1-57083-077-0. 2006.

Paper (*On the Appreciation of Constant Pressure Surfaces*) – in "Aviation Meteorology Unscrambled: For VFR and IFR Operations, Certificates and Ratings, 9th Edition. Chapter 18 – Contributed Papers on Various Aviation Weather Topics" Kenneth B. McCool, ISBN 978-0-9621387-2-0. 2006.

e-Book – *Scale-dependent approaches to modeling spatial epidemiology of chronic wasting disease*. Conner, Mary M., Gross, John E., Cross, Paul C., Ebinger, Michael R., **Gillies, Robert R.** and Miller, Michael M. Utah Division of Wildlife Resources, United States Geological Survey and, the International Association of Fish and Wildlife Agencies, Special Report 2007.

Book Chapter (*The Growth of Impervious Surface Coverage and Aquatic Fauna*) in Remote Sensing of Impervious Surfaces. Taylor and Francis Group. 2007.

*Non-Peer-Reviewed*:

M.K. Crombie, **R.R. Gillies**, G. Weil, R.E. Arvidson, P. Brookmeyer, M. Sultan, and M. Harb: Remote Sensing as a Tool for Assessing Environmental Risk Factors for Filariasis. Preprint volume of 10th Conference on Applied Meteorology, 20-23 October 1997, Reno, NV, by the *American Meteorological Soc*iety, Boston, MA.

Jiangsu Academy of Agricultural Sciences, Nanjing, P. R. China. International Symposium on Modeling for Crop-Climate-Soil-Pest System and Its Application in Sustainable Crop Production. 06/22-26/98.

**Gillies, R.R.**, Gottschalk, J. and Carlson, T.N.: The Simulation of Canopy Transpiration Under Doubled $CO_2$: The Evidence and Impact of Feedbacks on Transpiration in Two 1-D Soil-Vegetation-Atmosphere-Transfer (SVAT) Models. *American Water Resources Association*, Specialty Conference on Potential Consequences of Climate Variability and Change to Water Resources of the United States, 10-12 May 1999, Atlanta, GA.

**Gillies, R.R.**, Gottschalk, J: The Impacts of Regional Scale Transpiration Across North America in a Doubled $CO_2$ Environment Via Simulations with the GENESIS Global Climate Model. *American Water Resources Association*, Specialty Conference on Potential Consequences of Climate Variability and Change to Water Resources of the United States, 10-12 May 1999, Atlanta, GA.

**Gillies, R.R.** and Griffiths, L.: The Seasonal Energy Signature of the City of Atlanta, Georgia. *The Association of American Geographers*, 95th Annual Meeting, 23-27 March 1999, Honolulu, Hawaii.

Symanzik, J., Griffiths, L., **Gillies, R.R.**: Visual Exploration of Satellite Images, 2000 *Proceedings of the Section on Statistical Graphics*, American Statistical Association, Indianapolis, Indiana, August 13-17, 2000, pp10 -19.

Brunsell, N.A and **Gillies, R.R.**: *Proceedings 25th Agricultural and Forest Meteorology Meeting*. 20-24 may, 2002, Norfolk, Virginia. Length Scales of Remotely Sensed Vegetation, Surface Radiometric Temperature, and Derived Surface Energy Fluxes.

Brunsell, N.A and **Gillies, R.R.**, Lapenta, B. and Dembeck S.: *83rd American Meteorological Society Annual Meeting*. Symposium on Observing and Understanding the Variability of

Water in Weather and Climate. 9 – 13 February, 2003, Long Beach, California. Aggregation of Remotely Sensed Vegetation and Derived Latent Heat Flux.

John H. Prueger, USDA, Ames, IA; and W. P. Kustas, L. E. Hipps, J. L. Hatfield, A. Cahill, C. A. Williams, J. D. Albertson, W. E. Eichinger, D. I. Cooper, N. Brunsell, and **R. Gillies**. *83rd American Meteorological Society Annual Meeting*. Symposium on Observing and Understanding the Variability of Water in Weather and Climate. 9 – 13 February, 2003, Long Beach, California. 17th Conference on Hydrology. Spatial Variability of Turbulent Fluxes Across a Corn/Soybean Production Region in Central Iowa.

Symanzik, J., Gebreab, S., **Gillies, R**. Wilson, J. 2003: Visualizing the Spread of West Nile Virus, 2003 Proceedings, American Statistical Association, Alexandria, Virginia, CD.

## SCHOLARLY PRESENTATIONS

Carlson, T.N. and **Gillies, R.R.**, 1991: Remote sensing of soil moisture over vegetation. Sensitivity and limitations of the infrared temperature method. *Proceedings 20th Conference on Agricultural and Forest Meteorology*. Salt Lake City, UT, September 10-13, 1991.

Carlson, T.N. and **Gillies, R.R.**, 1993: A physical approach for inverting vegetation index with surface radiometric temperature to estimate surface soil water content. *Proceedings Thermal Remote Sensing of the Energy and Water Balance over Vegetation in Conjunction with Other Sensors*, La Londe Les Maures, France, 20-23 September 1993.

**Gillies, R.R.** and Carlson, T.N., 1993: Translation of satellite measurements to land surface parameters. *Proceedings, ERDAS Northern Regional User's Group Meeting*, Indiana University, 4-5 August 1993.

**Gillies, R.R.**, Olioso, A. and Humes, K., (Ed's): *Symposium Proceedings, Thermal remote sensing of the energy and water balance over vegetation in conjunction with other sensors*, La Londe Les Maures, France, 20-23 September 1993.

Miller, D.A., **Gillies, R.R.**, T.N. Carlson, E.M. Perry, D.A.J. Ripley and R.A. White, 1993: Scale similarities in the pattern of soil moisture as determined using visible and thermal infrared measurements over vegetation. *Proceedings American Meteorological Society Annual Meeting, Session on Climatology and Hydrology*, Pasadena, CA, 18-22 January 1993.

**Gillies, R.R.** and Carlson, T.N., 1994: An efficient method for incorporating remote multi-spectral measurements in land-surface models. *AGU*, Baltimore, MD, 23-27 May 1994.

**Gillies, R.R.**, Cui J., Carlson, T.N., Kustas, W.P. and Humes K.S., 1995: Implications of the NDVI and the surface radiant temperature relationship. *AMS* Conf. on Hydrology, Dallas, TX. January, 1995.

**Gillies, R.R.**, Rangeland Resources (CNR, Utah State University) - Sensitivity of Transpiration of Doubled Atmospheric $CO_2$ Concentration. 11/04/96.

**Gillies, R.R.**, Department of Earth and Planetary Science, Washington University, St. Louis, MO - Sensitivity of Transpiration of Doubled $CO_2$. 04/04/97.

**Gillies, R.R.**, Department of Earth and Planetary Science, Washington University, St. Louis, MO - Aspects of Multi-Spectral Remote Sensing - Applied to Land Surface Processes. 04/04/97.

Crombie M.K., **Gillies R.R.**, Weil G., Arvidson R.E., Brookmeyer P., Sultan M., and Harb M.: Tenth Conference on Applied Climatology - American Meteorological Society - Remote Sensing as a Tool for Assessing Environmental Risk Factors for Filariasis. 10/19/97.

**Gillies, R.R.**, Gottschalk, J. and Carlson, T.N.: Model Simulation of Canopy Transpiration under Doubled $CO_2$ Atmospheric Conditions. Jiangsu Academy of Agricultural Sciences, Nanjing, P. R. China. International Symposium on Modeling for Crop-Climate-Soil-Pest System and Its Application in Sustainable Crop Production. 06/22-26/98.

**Gillies, R.R.**, Second Biennial Conference on Higher Education in Natural Resources: Utah State University. A Graphical Surface-Vegetation-Atmosphere Transfer Model As a Pedagogical and Research Tool. 03/7-10/98.

**Gillies, R.R.**, Utah Geographical Society, 16th Annual Fall Meeting, 2 October 1998, Weber State University. Remote Sensing As a Tool for Assessing Environmental Risk Factors for Filariasis.

Quattrochi, D.A., J. C.Luvall, M. G. Estes,Jr, C. P. Lo, S. Q. Kidder, J. Hafner, H.Taha, R.D. Bornstein, **R.R.Gillies**, and K. P. Gallo. Project ATLANTA (ATlanta Land use ANalysis:Temperature and Air quality): A study of how the urban landscape affects meteorology and air quality through time. *American Meteorological Society*, 104-107,1998.

**Gillies, R.R.**, Gottschalk, J. and Carlson, T.N.: The Simulation of Canopy Transpiration under Doubled $CO_2$: The Evidence and Impact of Feedbacks on Transpiration in Two 1-D Soil-Vegetation-Atmosphere-Transfer (SVAT) Models. *American Water Resources Association*, Specialty Conference on Potential Consequences of Climate Variability and Change to Water Resources of the United States, 10-12 May 1999, Atlanta, GA.

**Gillies, R.R.**, Gottschalk, J.: The Impacts of Regional Scale Transpiration Across North America in a Doubled $CO_2$ Environment Via Simulations with the GENESIS Global Climate Model. *American Water Resources Association*, Specialty Conference on Potential Consequences of Climate Variability and Change to Water Resources of the United States, 10-12 May 1999, Atlanta, GA.

**Gillies, R.R.** and Griffiths, L.: The Seasonal Energy Signature of the City of Atlanta, Georgia. *The Association of American Geographers*, 95th Annual Meeting, 23-27 March 1999, Honolulu, Hawaii.

Boettinger, J.L., **Gillies R.R.**, Broderson W., Kienast S., and Jaros R.: Developing a multi-scale, open-ended soil inventory of the Grand Staircase - Escalante National Monument. International Conference on Soil Resources, June 1999, Minneapolis, MN.

**Gillies, R.R.** and Griffiths, L.: The Energy Signature of the City of Atlanta, Georgia. *International Symposium on Special Sensing Research*, Las Vegas, Nevada, October 31 – November 4, 1999.

Crombie M.K., **Gillies R.R.**, Weil G., Arvidson R.E., Brookmeyer P., Sultan M., and Harb M.: Remote Sensing as a Tool for Assessing Environmental Risk Factors for Filariasis.

*International Symposium on Special Sensing Research*, Las Vegas, Nevada, October 31 – November 4, 1999.

**Gillies, R.R.**: The determination of surface climatological fields from AVHRR. Department of Geography, University of Georgia, Athens, Georgia. May 13, 1999. **Invited.**

**Gillies, R.R.**: American Society of Photogrammetry and Remote Sensing, Intermountain Region Fall Technical Meeting. September 29, 2000. Worldwide Spread of Vector-borne Disease – Can Remote Sensing Help? **Invited.**

**Gillies, R.R.**, Qiming Qin, and Rongjian Lu College of Natural Resources. 11/29/00, College Seminar Series. Wavelet Analysis and Neural Networks in Radar Imagery Classification.

**Gillies, R.R.**: *The Association of American Geographers*, 97th Annual Meeting, February 27 - March 3, 2001, New York, New York. Radar Image Classification Using Wavelet Analysis and a Neural Network Configuration.

**Gillies, R.R.**, Brim Box, J. and Symanzik, J.: College of Natural Resources. 10/03/01, College Seminar Series. Effects of urbanization on the aquatic fauna of Line Creek, Atlanta – A Satellite Perspective.

Brunsell, N.A and **Gillies, R.R**: *25th Agricultural and Forest Meteorology Meeting.* 20-24 May, 2002, Norfolk, Virginia. Length Scales of Remotely Sensed Vegetation, Surface Radiometric Temperature, and Derived Surface Energy Fluxes.

**Gillies, R. R.**, 13th March 2003: Detection of Vector Bourne Diseases: A Satellite Perspective. The National Space Science and Technology Center, Marshall Space Flight Center, Huntsville, Alabama. **Invited**

**Gillies, R. R.**, Jürgen Symanzik, Samson Gebreab and James Wilson, 16-17 September 2003, McLean, Virginia: *Mathematical Modeling of the Spread of Agricultural Bioterrorism Agents*: Statistical and GIS Visualization of Vector-Borne Disease. **Invited**

Symazik, J., **Gillies, R. R.**, Gebraeb, S., Krishna, G., Ma, Peter and Wilson, J. Visualization, Web-Access, and Simulation of West Nile Virus Data – From the Regional to the National Level. Interface 2004, 36th Symposium on the Interface of Statistics, Computer Science, and Applications. May 28-31, 2004. Baltimore, Maryland. **Invited**

P. Rieke-Arentsen, **R. R. Gillies**, and N. Mesner, 13- 15 September 2004, Malaga, Spain. *Fourth International Conference on Management Information Systems: Incorporating GIS and Remote Sensing*: Satellite Derived Impervious Surface Area as an Indicator for Water Resource Impacts in a Semi-arid Environment, Utah, USA.

**Gillies, R. R.**, September 27 – 29, 2004, Park City, Utah. Spatial Epidemiology Tools for Chronic Wasting Disease Research and Management: Visualization of Geographically Referenced Statistical Epidemiological Summaries. **Invited**

Symanzik, J., **Gillies, R.**, Lee, H., and Ma, P. NDVI Data Reduction for Fuzzy Statistical Evaluation. *Interface 2006, 38th Symposium on the Interface of Statistics, Computer Science, and Applications*. May 24-27, 2006. Pasadena, California.

Gazal, R., White, M., **Gillies R.**, Sparrow, E., and Gordon, L. 2006. Urbanization Effects on Leaf Phenology Across a Multi-continent Bioclimatic Gradient. Organized Oral

Session on "Climate Change and Timing in Ecological Communities", 91st *Ecological Society of America Annual Meeting*, August 6-11, 2006. Memphis, Tennessee.

**Gillies, R.R.**, Gazal, R., White, M., and Rodemaker E. J. 2006. The Urban Heat Island Effect – Implications for Leaf Phenology. Session on "Thermal Remote Sensing Data for Earth Science Research", *AGU Fall Meeting*, 11-15 December 2006, San Francisco, California.

**Gillies, R. R.** 2007. Towards Integrating and Interpreting Climate Data for Agriculture. (Poster) Protecting The Homeland. A University Science and Education Exhibition and Reception of Capitol Hill. *National Association of State Universities and Land-Grant Colleges (NASULGC)*, February 28, 2007. Washington D.C.

Lawerence Hipps and **Robert Gillies**. 2007. Investigating the Wet Dry Cycles in Utah. (Poster). Spring Runoff Conference – Utah State University. April 5-6, 2007. Logan, Utah.

Gebreab Y. Samson, **Robert R. Gillies**, Symanzik Jürgen and Ronald G. Munger. 2007. Bayesian approach to mapping the spatial distribution of Oral Clefts in Utah. Session on " URISA GIS in Public Health", *Urban and Regional Information Systems Association (URISA) Conference*. May 20-23, 2007, New Orleans, Louisiana.

Gebreab Y. Samson, **Robert R. Gillies**, Symanzik Jürgen and Ronald G. Munger. 2007. Visualization of Birth Defects Data Using Linked Micromap Plots. Session on " URISA GIS in Public Health", *Urban and Regional Information Systems Association (URISA) Conference*. May 20-23, 2007, New Orleans, Louisiana.

**Robert R. Gillies**. 2007. Climate Change – Its Impact on Precipitation and Water Supply in Utah's Major Drainage Basins: The Colorado and the Great Basin. Featured Presentation "Utah Water Law, Water Rights and Water Quality: Stay Up to Date!" *15th Annual Superconference, Water Law Institute CLE International*. October 1-2, 2007, Marriott Downtown, Salt Lake City, Utah.

## AWARDS AND HONORS FOR TEACHING AND RESEARCH

**Walton Memorial Prize** for Work in Physical Geography (Scottish Geographical Society), Thesis presented as Glasgow University's submission, (1984).

May 25, 2000 ASPRS 2000 Annual Conference. **ERDAS Award for Best Scientific Paper in Remote Sensing** (American Society of Photogrammetry and Remote Sensing). Third Place for " An Application of remotely derived climatological fields for risk assessment of vector-borne diseases – A spatial study of filariasis prevalence in the Nile delta, Egypt, " M.K. Crombie, R.R. Gillies, R.E. Arvidson, P. Brookmeyer, G.J. Weil, M. Sultan, and M. Harb (*PE&RS.*,65-12, 1401-1409).

May 7, 2003 ASPRS 2003 Annual Conference. **Leica Geosystems Award for Best Scientific Paper in Remote Sensing** (American Society of Photogrammetry and Remote Sensing). Second Place for "Incorporating surface emissivity into a thermal atmospheric correction, " Nathaniel A. Brunsell and Robert R. Gillies (PE&RS., 68-12, pp. 1263-1269)

**Golden Mouse Award** (Utah State University) 2003. For outstanding innovation in technology, teaching and learning.

**EXTERNAL FUNDING**

*July 1985 - July 1987* **S.E.R.C** (Science and Engineering Research Council), Contract GR/D/11395. Thermal Mapping of Urban Developments using Remote Sensing Techniques.

*August 1987 - September 1990* **S.E.R.C**, Contract GR/E/20080. Numerical Modeling of the Urban Environment.

*January 1995* **NASA** Proposal # 9401011 Forest/Rangeland/Crop/Aquatic Ecosystems Program (National Research Initiative Competitive Grants Program). The Effect on Transpiration of Doubling Atmospheric Carbon Dioxide Concentration.

*September 1994* **NASA** Proposal # 94-5 Networking Infrastructure for Education. Earth System Science Community Testbed. Participant with Consortium for International Research, Collaboration, and Learning about the Earth System.

**NASA** Office of Mission to Planet Earth (Physical Climate Branch). 11/94 - 10/97. $341,755. "A Remotely Sensed Index of Deforestation / Urbanization for Use in Climate Models." (Co-Principal Investigator).

**NASA** Office of Mission to Planet Earth (Physical Climate Branch). 10/96 - 09/99. $183,983. "Remote Sensing and modeling of temporal changes in urban landcover." (Principal Investigator).

**NASA** Office of Mission to Planet Earth. 12/97 - 12/98. Enhancement of Remote Sensing Analysis Capabilities at Utah State University. $398,000. (Principal Investigator).

**National Science Foundation**. (Division of Atmospheric Sciences). 11/97 - 12/97. "Start-up Equipment for UNIDATA at Utah State University." $35,264 (Principal Investigator).

**NOAA/NASA** Joint GEWEX/GCIP Research Announcement. 12/97 - 12/2000. $479,663. Analysis of Spatial and Temporal Variability of the Warm Season Land Surface Energy Budget Using GOES Assimilation Techniques and Surface Flux Sites. (Co-Principal Investigator).

**NASA** 08/01/00 – 08/01/01. Extension of Atlanta/Houston Urban Heat Island Studies Using ASTER Imagery. $52,073.00. (Principal Investigator).

**SUN** Microsystems 05/12/00 Sun Microsystems Matching Equipment Grant Initiative. $66,000. (Principal Investigator).

**Mineral Lease** Internal Competitive. Advancement of Soil Survey for the Grand Staircase – Escalante National Monument Through Application of Landsat and EOS Platform Sensor Data. $35,000 (Co-Investigator with Dr. Janis Boettinger (PSB)).

**Agricultural Experiment Station** Internal non-competitive $10,000 per annum. Analysis of Spatial and Temporal Variability of the Warm Season Land Surface Energy Budget. Termination Date 06/30/2002.

**Agricultural Experiment Station** Internal non-competitive $10,000 per annum. Examination of Spatial Scale Effects in Land Atmosphere Interactions. Termination Date 06/30/2005.

**National Science Foundation** 09/06/02 – 09/06/06. Integrated Phenology Research and Education. $492,674 (Co-Principal Investigator with Dr. Michael White)

**Community / University Research Initiative** 06/01/02 – 06/01/03 Urban Planning and Satellite Remote Sensing: A Pilot Program for Planners. $25,000

**DOD** 09/01/02 – 08/31/04 Medical Vanguard Disease Surveillance. $103,574 (Principal Investigator)

Post-Doctoral Fellowship – Lee Hee Il – **Korea Science and Engineering Foundation** (KOSEF). $20,115 (Co-Investigator)

**Community / University Research Initiative** 06/01/05 – 06/01/06 Web-based Micromap Capabilities. $20,000

## ACADEMIC AND RESEARCH ADVISING

*Graduate Students*:

| Student | Degree (Major) | Status | Professor's Role |
|---|---|---|---|
| *Pennsylvania State University* | | | |
| Timothy Owen | M.S. (Meteorology) | Graduated 1995 | Committee Member |
| Cui Jui | M.S. (Meteorology) | Graduated 1996 | Major Professor |
| Jon Gottschalck | M.S. (Meteorology) | Graduated 1997 | Major Professor |
| *Utah State University* | | | |
| Nathaniel Brunsell | Ph.D (Biometeorology) | Graduated 2002 | Major Professor |
| Jerry Tagestad | M.S. (Geography) | Graduated 1998 | Directed Thesis |
| Joshua Campbell | M.S. (Biometeorology) | Graduated 2006 | Major Professor |
| Louise Griffiths | M.S. (Geography) | Graduated 2006 | Major Professor |
| Eli Rodemaker | M.S. (Geography) | Graduated 2006 | Major Professor |
| Bekele Temesgen | Ph.D (Biometeorology) | Graduated 2006 | Directed Thesis |
| Penny Rieke Artentsen | M.S. (Watershed Science) | Graduated 2005 | Co-advisor |
| Gopi Krishna Chapala | M.S. (Computer Science) | Graduated 2004 | Directed Thesis |
| Samson Gebreab | Ph.D (Ecology) | Ongoing | Major Professor |
| Peter Ma | M.S. (Geography) | Graduated 2006 | Major Professor |
| Ravi Kiran | M.S. (Computer Science) | Graduated 2006 | Directed Thesis |
| Vineela Valllabhaneni | M.S. (Computer Science) | Ongoing | Thesis Advisor |

*Graduate Committees (excluding above)*:

3 Ph.D. (Civil & Environmental Engineering; Plants, Soils and Climate)

9 M.S. (Geography and Earth Resources, Forest Resources, Plants, Soils and Climate, Civil & Environmental Engineering, Computer Science, Watershed Sciences)

*Visiting Professors / Scholars:*

Dr. Hee Lee from the Republic of Korea, Fall 2001 – Spring 2002. Attending Utah State University by virtue of a competitive overseas research fellowship awarded by the Korean government. Dr. Lee is a medical entomologist whose interests lie in detecting Malaria breeding habitats using remote sensing and GIS.

Samson Yikealo Gebreab from Eritrea, August 2002 – January 2003. Studying MSc in Geographic Information Sciences at Wageningen. Fulfilling his thesis Master's research at Utah State University with Dr. Gillies.

Dr. Hee Lee from the Republic of Korea, Spring 2004 – Fall 2006. Attending Utah State University by virtue of a competitive overseas research fellowship awarded by the Korean government.

## TEACHING

*Courses Taught*:

*Pennsylvania State University*

| | |
|---|---|
| METEO 02 | *Weather and Society* |
| METEO 03 | *Lab supplement for Meteo 02* |
| METEO 472 | *Climatology* |
| METEO 467E / Earth 497E | *Investigation of the Earth System Biosphere Atmosphere Interactions (Land Surface Processes)* |
| METEO 567C | |
| METEO 454 | *Micrometeorology* |
| METEO 421 | *Dynamic Meteorology I* |

*Utah State University*

| | | |
|---|---|---|
| GEOG / BMET 3280 | *Global Climatology* | 97 – 00 |
| GEOG 4750 | *Fundamentals of Remote Sensing* | 98 – 05 |
| BMET 3250 | *Aviation Weather* | 97 – |
| BMET / BIE 5250/6250 | *Remote Sensing of Land Surfaces* | 99 – 03 |
| GEOG 6980 - 2 | *Imagine Toolkit* | Spring 2001 |
| GEOG 6900 | *Programming for Remote Sensing and GIS Environments* | Spring 2002 |

*Teaching Activities / Development*:

Selected participant (by review) in the 1997 Summer Workshop "Using Instructional Technological and Satellite Data for College-Level Education in the Atmospheric and Earth Sciences," sponsored by the National Science Foundation and COMET.

Participant in "Shaping the Future, Unidata Users as Leaders". June 19-23, 2000. Sponsored workshop by the National Science Foundation. **Invited**

Participant in a workshop on ***Accelerated Learning Training Methods*** with Dave Meier (from The Center for Accelerated Learning). **Invited**

*Mentoring Activities / Development*

September 12, 2002 Annual MGE@MSA Faculty Doctoral Mentoring Institute Mentor for Underrepresented Minority Doctoral Students. **Invited**

## PROFESSIONAL ACTIVITIES

*Society Memberships*:

American Meteorological Society
Association of American Geographers
American Geophysical Union
International Association of Hydrological Sciences
American Society of Photogrammetry and Remote Sensing

*Manuscript, Book and Proposal Reviews*:

The Journal of Forestry
The International Journal of Remote Sensing
Natural Environmental Research Council, U.K.
Urban Ecosystems
California Department of Food and Agriculture
Remote Sensing of Environment
International Journal of Remote Sensing
Theoretical and Applied Climatology
American Water Resources Association (AWRA)
Utah Agricultural Experiment Station at Utah State University
Cooperative State Research, Education, and Extension Program

Weather and climate: cause, course, effect, animation. Harald Frater (ed.), Springer-Verlag, 1999, ISBN, 3-540-14667-9. **Gillies, R.R.**, *Agricultural and Forest Meteorology.*, **2823** (2000) 1-2.

*Workshops / Conference*:

Invited team-member of Thermal Inertia Mapping Experiment (TIMEX) satellite science team. Proposed thermal IR satellite concept being developed at JPL for submission as an Earth System Science Pathfinder project.

Remote Sensing and Image Processing Workshop, Tuscon, Arizona, April 13 – 15, 1999. Sponsored by NASA (**Invited**)

International assessor for "the midterm presentation of the programme Earth Observation" 28 – 29 October 1999 at the Sorø Strorko, Denmark.

International participant **(invited)** of the GEWEX workshop on status of SVAT modeling. Sponsored by World Meteorological Organization.

Human Health, Urbanization, and Remote Sensing Workshop **(invited)** April 10, 2001. The Rollins School of Public Health, Emory University, Atlanta, Georgia, USA.

Observer **(invited)** WHO meeting on the Prevention of Craniofacial Anomalies, 24-26 May 2001, Utah, USA

Integrated Research Team: The Role of Indications and Warnings for Prediction and Surveillance of Catastrophic Biological Events. 28 – 30 June, 2004 **(invited)**

## OTHER AWARDS & HONORS

Chi Epsilon Pi -- The Pennsylvania State University, Meteorological Honors Society, (1989).

Catherine Clarke Trophy for Outstanding Contribution to University Sport, University of Glasgow, (1984).

**John D. Horel**
Professor
Department of Meteorology
University of Utah
Office: 486 INSCC
Mail: 135 South 1460 East Rm 819
Salt Lake City 84112
Phone: (801) 581-7091
Fax: (801) 581-4362
Email: john.horel@utah.edu

## EDUCATION

- Ph.D. 1982, Atmospheric Sciences, University of Washington
- B.S. 1977, Meteorology, San Jose State University

## PROFESSIONAL EXPERIENCE

- 1996-present, Professor, Meteorology, University of Utah
- 2002-2006, Director, NOAA Cooperative Institute for Regional Prediction, University of Utah
- 1996-1998, Acting Director, NOAA Cooperative Institute for Regional Prediction, University of Utah
- 1990-1996, Associate Professor, Meteorology, University of Utah
- 1986-1990, Assistant Professor, Meteorology, University of Utah
- 1982-1986, Assistant Research Professor, Scripps Institution of Oceanography

## RESEARCH ACTIVITIES

My research is centered on the observation and analysis of weather and climate processes in mountainous regions. Building on a decade of applied research within the framework of the NOAA Cooperative Institute for Regional Prediction, the Mountain Meteorology Group has now been established as a center of excellence within the Department of Meteorology. My current research activities include further development of MesoWest (see http://www.met.utah.edu), which provides access to surface weather observations for operational, research, and educational applications. MesoWest has evolved since 1996 from providing weather information at a few dozen weather stations in northern Utah to the current availability of weather conditions at thousands of stations around the nation using a state-of-the-art database and dozens of tabular and graphical displays. The MesoWest observations also provide a foundation from which to conduct research to improve data assimilation techniques over complex terrain. I participate in a National Weather Service effort to develop a mesoscale Analysis of Record and its prototype the Real Time Mesoscale Analysis. I also am involved in research related to the Great Salt Lake, including the causes and impacts of interannual variations in the level, salinity, and temperature of the Lake.

AWARDS

- Fellow of the American Meteorological Society 2002
- Outstanding Service Award, National Weather Service Western Region, "For outstanding service to the weather support group for the 2002 Olympic Winter Games" 2002
- College of Mines and Earth Sciences Outstanding Teacher Award 1993-94

COURSES TAUGHT DURING THE PAST TEN YEARS

- Meteorology 1010: Severe and Unusual Weather
- Meteorology 1020: Climate Change: An Atmospheric Perspective (course developer)
- Meteorology 2810: Undergraduate Seminar
- Meteorology 3000/Geography 3280: Mountain Weather and Climate (course developer)
- Meteorology 3410: Weather Analysis and Prediction I (course developer)
- Meteorology 3510: Weather Analysis and Prediction II (course developer)
- Meteorology 5120/6120: Applied Mathematics and Statistics for Environmental Scientists
- Meteorology 5140/6140: Mesoscale and Radar Meteorology
- Meteorology 5540: Synoptic Meteorology II
- Meteorology 5550: Mountain Meteorology (co-course developer)
- Meteorology 6010: Fundamentals of Dynamic Meteorology
- Math 6790: Case Studies in Computational Engineering and Science

REFEREED PUBLICATIONS

Texts and Book Chapters

Horel, J. D., and J. E. Geisler, 1996: Global Environmental Change: An Atmospheric Perspective. 165 pp. John Wiley and Son.

Horel, J., 2003: Terrain-forced mesoscale circulations. Handbook of Weather, Climate, and Water: Dynamics, Climate, Physical Meteorology, Weather Systems, and Measurements. Edited by T. Potter and B. Colman. Wiley and Sons. 562-573.

Journal Publications

Myrick, D., and J. Horel 2007: Sensitivity of surface analyses over the western United States to RAWS observations. *Wea. Forecasting*. Accepted.

Zumpfe, D., J. Horel, 2007: Lake-breeze fronts in the Salt Lake Valley.J. Appl. Meteor., 46- 196-211.

Myrick, D., J. Horel, 2006: Verification over the Western United States of Surface Temperature Forecasts from the National Digital Forecast Database. Wea. Forecasting, 21, 869-892.

Horel, J., B. Colman, 2005: Meeting Summary: A Community Meeting on Real-Time and Retrospective Mesoscale Objective Analysis: An Analysis of Record Summit. *Bull. Amer. Meteor. Soc.,* 86, 1477–1480.

Myrick, D., J. Horel, S. Lazarus, 2005: Local Adjustment of the Background Error Correlation for Surface Analyses over Complex Terrain. *Wea. Forecasting,* 20, 149-160.

Ludwig, F., J. Horel, C. D. Whiteman, 2004: Using EOF analysis to identify important surface wind patterns in mountain valleys. J. Appl. Meteor., 7, 969-983.

Clements, C. B., C. D. Whiteman, J. D. Horel, 2003: Cold air pool structure and evolution in a mountain basin. J. Appl. Meteor. 42, 752-768.

Doran, C., J. Fast, J. Horel, 2002: The VTMX 2000 Campaign. Bull. Amer. Meteor. Soc., 83, 537- 551.

Lazarus, S., C. Ciliberti, J. Horel, K. Brewster, 2002: Near-real-time Applications of a Mesoscale Analysis System to Complex Terrain. Wea. Forecasting, 17, 971-1000.

Horel, J., T. Potter, L. Dunn, W. J. Steenburgh, M. Eubank, M. Splitt, and D. J. Onton, 2002: Weather support for the 2002 Winter Olympic and Paralympic Games. Bull. Amer. Meteor. Soc., 83, 227-240

Horel, J., M. Splitt, L. Dunn, J. Pechmann, B. White, C. Ciliberti, S. Lazarus, J. Slemmer, D. Zaff, J. Burks, 2002: MesoWest: Cooperative Mesonets in the Western United States. Bull. Amer. Meteor. Soc., 83, 211-226.

Schultz, D. M., W. J. Steenburgh, R. J. Trapp, J. Horel, D. E. Kingsmill, L. B. Dunn, W. D. Rust, L. Cheng, A. Bansemer, J. Cox, J. Daugherty, D. P. Jorgensen, J. Meitin, L. Sho well, B. F. Smull, K. Tarp, and M. Trainor, 2002: Understanding Utah winter storms: The Intermountain Precipitation Experiment. Bull. Amer. Meteor. Soc., 83, 189-210.

White, Bryan G., Paegle, Jan, Steenburgh, W. James, Horel, John D., Swanson, Robert T., Cook, Louis K., Onton, Daryl J., Miles,John G. 1999: Short-Term Forecast Validation of Six Models.Wea. Forecasting. 14, 84-108.

Waldron, Kim M., Paegle, Jan, Horel, John D. 1996: Sensitivity of a Spectrally Filtered and Nudged Limited-Area Model to Outer Model Options. Mon. Wea. Rev., 124, 529-552.

Dunn, Lawrence B., Horel, John D. 1994: Prediction of Central Arizona Convection. Part II: Further Examination of the Eta Model Forecasts.Wea. Forecasting, 9, 508-521.

Dunn, Lawrence B., Horel, John D. 1994: Prediction of Central Arizona Convection. Part I: Evaluation of the NGM and Eta Model Precipitation Forecasts.Wea. Forecasting, 9, 495-507.

Horel, John D., Gibson, Chris V. 1994: Analysis and Simulation of a Winter Storm over Utah. Wea.Forecasting. 9, 479- 494.

Horel, John D., Pechmann, Judith B., Geisler, John E., Hahmann, Andrea N. 1994: Simulations of the Amazon Basin Circulation with a Regional Model.J. Climate. 7, 56-71.

Berbery, Ernesto H., Nogues-Paegle, Julia, Horel, John D. 1992: Wavelike Southern Hemisphere Extratropical Teleconnections.J. Atmos. Sci., 49, 155-177.

Sassen, Kenneth, Horel, John D. 1990: Polarization Lidar and Synoptic Analyses of an Unusual Volcanic Aerosol Cloud. J. Atmos. Sci. 47, 2881-2889.

Barker, Timothy W., Horel, John D. 1989: The Impact of Climatology and Systematic Errors upon the Skill of DERF Forecasts. Mon. Wea. Rev., 117, 2835-2842.

Horel, John D., Hahmann, Andrea N., Geisler, John E. 1989: An investigation of the Annual Cycle of Convective Activity over the Tropical Americas. J. Climate, 2, 1388-1403.

Horel, John D., Staley, Lloyd R., Barker, Timothy W. 1988: The University of Utah Interactive Dynamics Program- One Approach to Interactive Access and Storage of Meteorological Data. Bull. Amer. Meteor. Soc., 69, 1321-1327.

Horel, John D., Mechoso, Carlos R. 1988: Observed and Simulated Intraseasonal Variability of the Wintertime Planetary Circulation.J. Climate, 1, 582-599.

Barker, Timothy W., Horel, John D. 1988: Quasi-Stationary Regimes in the Northern Hemisphere of the NCAR Community Climate Model.J. Climate, 1, 406- 417.

Horel, John D., Cornejo-Garrido, Angel G. 1986: *Convection along the Coast of Northern Peru during 1983: Spatial and Temporal Variation of Clouds and Rainfall. Mon. Wea. Rev., 114, 2091-2105.

Horel, John D. 1985: Persistence of Wintertime 500 mb Height Anomalies over the Central Pacific. Mon. Wea. Rev., 113, 2043-2048.

Horel, John D. 1985: Persistence of the 500 mb Height Field during Northern Hemisphere Winter. Mon. Wea. Rev., 113, 2030-2042.

Horel, J. D. 1984: Complex Principal Component Analysis: Theory and Examples.J. Appl. Meteor., 23, 1660-1673.

Van Den Dool, H.M., Horel, J.D. 1984: An Attempt to Estimate the Thermal Resistance of the Upper Ocean to Climatic Change. J. Atmos. Sci., 41, 1601-1612.

Horel, John D. 1982: On the Annual Cycle of the Tropical Pacific Atmosphere and Ocean. Mon. Wea. Rev., 110, 1863-1878.

Horel, John D., Wallace, John M. 1982: Reply. Mon. Wea. Rev., 10, 1497-1497.

Horel, John D. 1981: A Rotated Principal Component Analysis of the Interannual Variability of the Northern Hemisphere 500 mb Height Field. Mon. Wea. Rev., 109, 2080-2092.

Horel, John D., Wallace, John M. 1981: Planetary-Scale Atmospheric Phenomena Associated with the Southern Oscillation. Mon. Wea. Rev., 109, 813-829.

GRADUATE STUDENTS (area of employment)

- Current: E. Crosman, L. Jones, B. Olsen, D. Tyndall
- D. Myrick, 2006, Ph.D. (NWS)
- E. Crosman, 2005, M.S. (student)
- D. Zumpfe, 2004. M.S. (NWS)
- D. Myrick, 2003. M.S. (NWS)
- L. Holland, 2002. M.S. (NCAR)
- L. Cheng, 2002. M.S. (NWS)
- C. Clements, 2001. M.S. (Faculty SJSU)
- R. Swanson, 1998. Ph.D. (Air Force)
- J. Slemmer, 1998. M.S (NWS)
- A. Haynes, 1998. M.S. (NWS)
- B. McDonald, 1998. Ph.D. (NWS)
- J. Stiff, 1997. M.S. (Broadcasting)
- M. Braby, 1997. M.S. (Commercial firm)
- J. Mittelstadt, 1995. Ph.D. (NWS)
- R. Swanson, 1995. M.S. (Air Force)
- C. Gibson, 1993. M.S. (NWS)
- L. Dunn, 1993. Ph.D. (NWS)
- A. Hahmann, 1992. Ph.D. (NCAR)
- T. Barker, 1991. Ph.D. (NWS)
- C. Jones, 1990. M.S. (Research Faculty UCSB)

SELECTED PROFESSIONAL ACTIVITIES

- Co-chair. WAF/NWP AMS Conference. June 2007
- Member. WAF/NWP statement writing team. 2007
- Covenor. Thirteenth Workshop on Weather Prediction in the Intermountain West. Nov. 2006

- Clarus Quality Checking Task Force. Federal Highway Administration. May 2006.
- Department Review Panel. Department of Atmospheric and Environmental Science. Creighton University. April 2005.
- Co-Chair. Mesoscale Analysis Committee. National Weather Service Office of Science and Technology. 2004-present.
- Member of NSF LEAD external advisory panel 2004-present (Chair 2006-present)
- Member of the Scripps Experimental Climate Prediction Center advisory panel 1999-present
- Covenor and Co-Covenor of First-Ninth Workshops on Weather Prediction in the Intermountain West (1994-2002)
- Member of external 10-year institutional review panel for the Desert Research Institute 2002
- Contributor to Olympic Weather Support Team for the 2002 Winter Olympic and Paralympic Games (1996-2002)
- Member of the U.S. CLIVAR Pan American Climate Studies Panel. 1999-2000
- Member of the Scientific Steering Group for the Pan American Climate Systems Program of the NOAA Office of Global Programs: 1994-1999
- Co-Lead Instructor UCAR/COMET COMAP Course. Summer 1997
- Member of the American Meteorological Society Panel on Climate Variations 1994-1997
- Member of the NCEP EMC review panel 1996
- Member of College of Mines and Earth Sciences committees (e.g., computer 1988-1993, committee chair 1991-1993; curriculum 2000-present; retention and promotion 1996-1998, 2001-2002, 2005-present)

RECENT INVITED PRESENTATIONS

- April 2007. National Weather Service SOO/DOH Workshop. Salt Lake City UT
- December & March 2006. COMET Olympic Winter Weather Training Course. Boulder CO
- July 2006. Instructor for COMET faculty course on instructional uses of multimedia. Boulder CO.
- July 2006. Empirical Models and Data Assimilation. Unidata Users Workshop. Boulder CO.
- March 2006. National Weather Service Western Region Climate Services Workshop. Salt Lake City, UT.
- February 2006: National Weather Service S591 Fire Meteorologist Training Course. Boise, ID
- October 2005: Department of Atmospheric Sciences. University of Washington
- March 2005: Department of Geography. University of Utah
- March 2005: Western Region National Weather Service. Meteorologist in Charge Workshop. Portland OR
- March 2005: Department of Atmospheric Sciences. Texas A&M

- February 2005: Western Region National Weather Service. Science and Operations Officer Workshop. Salt Lake City UT
- September 2004: University of Oklahoma. College of Meteorology
- June 2004: NWS/UCAR COMET course on boundary layer meteorology
- March 2004: National Fire Weather Course- S591
- March 2004: Incident Meteorologist Workshop
-

FEDERAL AND OTHER RESEARCH SUPPORT DURING THE PAST TEN YEARS

Cooperative Institute for Regional Prediction. Agency: NOAA. Total amount: $375,000. Period covered: July 2007-June2010. (Co-PIs J. Steenburgh, D. Whiteman).

Cooperative Institute for Regional Prediction. Agency: NOAA. Total amount: $375,000. Period covered: July 2004-June 2007. (Co-PI J. Steenburgh)

Development of a Nationwide, Weather Observation Monitor for Fire Weather Applications. Agency: BLM. Total amount: $720,000. Period covered: July 2002-Sep 2007

CIRP Consortium: Contributions from government and private sources.

Climate Applications of MesoWest. U/Utah VP for Research Seed funding. $33,500. 1/06-12/06

Weather and Climate Variations Associated with the Great Salt Lake, NASA, $72000, 9/07-8/10

Utilization of MesoWest Data in the DHS Biological Warning Incident Program. $30000, 3/06-2/08

Improved Integration and Coordination between UDOT RWIS Program and the University of Utah MesoWest Program. Utah Department of Transportation, $50,000, 7/05-6/07.

Evaluation of the NCEP Regional Reanalyses over Complex Terrain. Agency: NOAA Office of Global Programs. Total amount: $245,897. Period covered: March 2004-February 2007. (Co-PI J. Steenburgh, W. Cheng)

Cooperative Institute for Regional Prediction. Agency: NOAA. Total amount: $500,000. Period covered: January 2000-June 2004. (Co-PI T. Potter, J. Steenburgh)

Analysis of the Planetary Boundary Layer in an Urban Valley. Agency: DOE. Total amount: $378,000. Period covered: Nov. 1999-Oct. 2004. (Co-PI S. Lazarus)

Planning Weather Support for the 2002 Winter Olympics. Agency: NOAA. Total amount: $380,000. 4/00-3/02. (Co-PI T. Potter, J. Steenburgh)

Mesoscale Modeling Studies of Warm Season Rainfall in the PACS Domain. Agency: NOAA OGP. Total amount: $171,686. Period covered: March 1998-March 2000. (Co-PI J. Steenburgh)

Evaluation and Application of the Eta Adjoint Model. Agency: NSF. Total amount: $105,900. Period covered: June 1996-May 1998.

Regional Climate Simulations over the Tropical Americas. Agency: NOAA. Award amount: $171,000. Award dates: May 1995-April 1997. (Co-PI J. Pechmann)

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# Randall P. Julander

**Education**

1976 – 1979 Utah State University - Logan, Utah
BS Watershed Management
1983 – 1984 Utah State University - Logan, Utah
MS Forest Watershed Management

**Professional experience**

1979 – 1980 - Hydrologic Technician, Bureau of Land Management, Glenwood Springs Colorado
1980 – 1981 - Hydrologic Technician, US Forest Service, Boise Idaho
1981 – 1982 - Hydrologist, Bureau Of Land Management, Denver Colorado
1982 – 1983 - Hydrologist, Agricultural Research Service, Sydney Montana
1984 – 1991 - Hydrologist, Colorado Basin River Forecast Center
1991 – Current - Hydrologist, Snow Survey Supervisor, Natural Resources Conservation Service, USDA
1999 – Current Adjunct Professor, University of Utah, Teaching Snow Hydrology

- As Snow Survey Supervisor, I am responsible for the collection, processing and archival of snow and hydrometerological data from Utah, Nevada and parts of California. These data are used in water management functions by local, state and federal governments as well as private organizations and individuals. We produce water supply forecasts, in order to more effectively manage water resources for agriculture, hydroelectric, reservoir operations, municipal supplies, droughts, floods and all manner of water related problems. We provide accurate and timely information on snowmelt and runoff. We also provide consultation and training on data monitoring systems, data collection, processing, archival, application and use. Expert in the use of historical data relative to climate applications. In previous experience: expert in hydrologic modeling: SRM, DamBreak, Snow17, Sacramento and others.

**Publications**

Frequency and Temperature Analysis of the 1983 Wasatch Front Floods.

Improvements in Developing Water Supply Forecasts

Drop Former vs Ponding Ring Infiltrometers, a Comparison.

Water, Salt and Sediment yields from 3 Mancos Shale soils in Eastern Utah

Flooding and the SNOTEL System

The Franklin Basin Problem and Solution

Soil Moisture and Water Supply

Soil Moisture and Water Supply, the Sequel

A Historical Comparison of Snowpack Averages in Utah

Soil Moisture and Water Supply Forecasting

An analysis of the timing of snow course measurement and the potential error compared to April 1 measurements in Utah

The impacts of soil type and sensor location on soil moisture data

An examination of external influences embedded in the historical snowpack data of Utah

Floods, droughts and extremes in Utah Snowpack

The SNOTEL temperature dataset

Soil surface temperature difference between steel and hypalon pillows

**Professional memberships**

Western Snow Conference

**Languages**

English and German

# David G. Long, Ph.D.

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## Education:

**1989** **Ph.D. University of Southern California**. Electrical Engineering. Advisor: Prof. Jerry Mendel, Chair EE-Systems Dept.

**1983** **M.S. Brigham Young University**. Electrical Engineering. Cum Laude.

**1982** **B.S. Brigham Young University**. Electrical Engineering. Summa Cum Laude.

## Experience:

**1990-** **Brigham Young University.** Provo, Utah

***Professor of Electrical and Computer Engineering***. (1999-) Teach undergraduate and graduate courses in electrical engineering. Conduct research in spaceborne scatterometry, synthetic aperture radar, and microwave remote sensing. Mentor undergraduate and graduate students. Mentor new faculty. University, college, and department committee assignments.

***Associate Professor of Electrical and Computer Engineering***. (1994-99)

***Assistant Professor of Electrical and Computer Engineering***. (1990-94)

***Director*, BYU Center for Remote Sensing**. (2000-) Coordinate, promote, and direct BYU interdisciplinary remote sensing activities across the University. Manage support staff. Develop academic support program.
*http://www.cers.byu.edu/*

***Head*, Microwave Earth Remote Sensing (MERS) Laboratory**. (1991-) Direct research in microwave remote sensing. Coordinate research and laboratory resources among faculty and students. Manage the acquisition and maintenance of laboratory computer and microwave test equipment. Manage support staff.
*http://www.mers.byu.edu/*

***Principal Investigator***. (1990-) NASA, NSF, NOAA, and DoD sponsored research projects. Selected titles include "Boundary Layer Modeling of Surface Winds Using NSCAT Data," "Model-Based Wind Retrieval of Wind Fields Using Seasat Scatterometer Data," "High Resolution Imaging of Land and Ice Using SASS Data," "Research in Oceanic Air/Sea Interaction," "Geologic Applications of Small SAR," "Scatterometer Climate Record Pathfinder," "Application and Extension of the Scatterometer Climate Record Pathfinder," "MicroSAR for small UAV." Member of a number of NASA and international science teams.

***Instructor, BYU Education Week***. (1995-2005) Give1-3 public lectures per year

**1990-** **Consultant**. Technical expertise in scatterometer performance and design analysis, radar resolution enhancement, and radar remote sensing. Teach short courses.

**1983-1990** **Jet Propulsion Laboratory, California Institute of Technology (JPL).** Pasadena, California.

***Experiment Manager*, SCANSCAT Project.** (1989-90) Senior manager responsible for all technical and programmatic aspects of the SCANSCAT Project in the development and proposal phase. Eventually known as *SeaWinds*, this highly successful $250 M project resulted in two successful launches and one extended mission (*SeaWinds-on-QuikSCAT*: 1999-present). Managed and coordinated all JPL design and development efforts among staff spread over multiple disciplines at JPL. Prepared and negotiated budgets and technical requirements between JPL, NASA headquarters, other NASA centers, and contractors.

***Project Engineer*, Spaceborne Scatterometer Projects Office.** (1988-90) Senior technical manager for the JPL scatterometer projects office. Responsible for the high level design, analysis, and technical management of the scatterometer projects including instrument design and fabrication, algorithm development and coding for the ground processing system, mission operations, calibration data analysis, system performance analysis, and development and maintenance of system and low-level requirements. Supervised Project Engineering staff. Managed large multi-disciplinary design team. Functioned as interface between scientists, engineering support teams, and upper management.

***Group Leader*, Radar Systems Engineering.** (1988-90) Supervised a staff of 5 radar system engineers involved in the design and performance analysis of JPL flight projects in spaceborne radar remote sensing including the SIR-C and Magellan synthetic aperture radars and the NSCAT, NUSCAT, and SCANSCAT scatterometer missions. Responsibilities included personnel hiring, task assignment, project reporting, and managing and negotiating budgets.

***Principal Investigator*.** (1989-90) NASA-sponsored research project "Model-Based Wind Retrieval of Wind Fields Using Seasat Scatterometer Data."

***Member Technical Staff*.** (1983-1987) Developed requirements and the high-level design for the NASA Scatterometer (NSCAT) project as the NSCAT Instrument Systems Engineer. Developed performance analysis tools and performed tradeoffs in developing the onboard signal processor design and the ground processing system. Managed technical development in supporting disciplines.

**1982** **ESL, Inc.** Sunnyvale, California (summer hire)

***Member Technical Staff*.** Studied the effects of bit errors in digital communication channels on the intelligibility of LPC-coded speech.

**1980-1981** **Timet Corp.** Henderson, Nevada (summer hire)

***Engineer*.** Designed custom analog and digital control systems for high-power vacuum arc furnaces and molten salt electrolytic cells.

**Publications:**

Seventy-on refereed journal papers and three book chapters. Over 250 conference papers and technical conference presentations. Co-authors include distinguished scientists, faculty members, and students.

**Awards:**

**2005** **IEEE *Best Paper of the Year, Trans. Geoscience and Remote Sensing.*** With David W. Draper.

**2004** **BYU *Sponsored Research Award.*** For outstanding achievement in scholarly activities funded by external sponsors.

**2004** **Utah County Sheriff *Citizen Service Award.*** For contributions to search and rescue activities.

**2002** **BYU *Karl G. Maeser Excellence in Research and Creative Arts Award.*** For outstanding research and creative accomplishments.

**2001** **BYU *Martha Jane Knowlton Coray Professorship.*** To acknowledge senior faculty who are outstanding scholars, teachers, and university citizens.

**2000** **NASA *Group Achievement Award.*** For outstanding performance in the development, launch and operations of the Quick Scatterometer spacecraft.

**1997** **NASA *Team Recognition.*** In recognition of proficient advice on scientific requirements during the development of the mission, successful development of methods for optimal data retrieval and outstanding early demonstration of scientific application of NSCAT observations.

**1986,'88,'91,'91,'92 NASA *Certificate of Recognition.*** For technical papers on scatterometer instrument design, analysis, and data processing.

**1986,'88** **NASA *Certificate of Recognition.*** For the development of a sophisticated computer graphics package which was commercially distributed by NASA's Computer Software Management and Information Center (COSMIC). The package was among the center's most popular program packages for several years.

**Research Interests:**

Microwave remote sensing, spaceborne scatterometry, synthetic aperture radar, speech and signal processing, radar theory, estimation theory, computer graphics, resolution enhancement, scattering theory, polar ice, and mesoscale atmospheric dynamics.

**Society Memberships:**

Senior Member IEEE (nominated for Fellow), American Geophysical Union, and Tau Beta Pi, Eta Kappa Nu, Phi Kappa Phi, and Sigma Xi honor societies. Currently faculty advisor for Eta Kappa Nu. Past faculty advisor for Tau Beta Pi.

**NASA Science Teams:**

Past or current member of science teams: *NASA Scatterometer, SeaWinds, Ocean Vector Winds, TRMM, JASON-1, and ESA ERS-2.* Chair of the NSCAT model function subcommittee. Chair of the QuikSCAT/Seawinds Committee on Model Functions.

**Students:**

One post-doc, eight Ph.D. students completed with five currently in progress, 25 Masters students completed with five in progress. Completed students work in academia, in industry and for government laboratories. Numerous undergraduate students were also mentored as research students.

**Major Research Grants:**

Over 30 externally funded research grants totaling approximately $7M. Sponsors include NASA, NSF, DoD, and NOAA.

**Selected Journal Publications** (* denotes student authors)


J.Piepmeir, E.G. Njoku, and D.G. Long "Stokes Antenna Temperatures," to appear, *IEEE Transactions on Geoscience and Remote Sensing*, 2007.

H. Stephen and D.G. Long, "Spatial and Temporal Behavior of Microwave Backscatter Directional Modulation Over the Saharan Ergs," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 45, No. 5, pp. 1164-1173, 2007.

C. Nie and D.G. Long, "A C-band Wind/Rain Backscatter Model," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 45, No. 3, 621-631, 2007.

I.S. Ashcraft and D.G. Long, "Comparison of Methods for Melt Detection over Greenland using Active and Passive Microwave Measurements," *International Journal of Remote Sensing*, Vol. 27, No. 12, pp. 2569-2488, 2006.

I.S. Ashcraft and D.G. Long, "Relating Microwave Backscatter Azimuth Modulation to Surface Properties of the Greenland Ice Sheet," *Journal of Glaciology*, Vol. 52, No. 177, pp. 257-266, 2006.

L.B. Kunz and D.G. Long, "Melt Detection in Antarctic Ice-Shelves Using Spaceborne Scatterometers and Radiometers," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 44, No. 9, pp. 2461-2469, 2006.

J.R. Allen and D.G. Long, "Microwave Observations of Daily Antarctic Sea-Ice Edge Expansion and Contraction Rates," *Geoscience and Remote Sensing Letters*, Vol. 3, No. 1, pp. 54-58, 2006.

H. Stephen and D.G. Long, "Modeling Microwave Emissions of Erg Surfaces in the Sahara Desert," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 43, No. 12, pp. 2822-2830, 2005.

J.R. Allen and D.G. Long, "An Analysis of SeaWinds-Based Rain Retrieval in Severe Weather Events," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 43, No. 12, pp. 2870-2878, 2005.

L.B. Kunz and D.G. Long, "Calibrating SeaWinds and QuikSCAT Scatterometers Using Natural Land Targets," *Geoscience and Remote Sensing Letters*, Vol. 2, No. 2, pp. 182-186, 2005.

I.S. Ashcraft and D.G. Long, "Differentiation Between Melt and Freeze Stages of the Melt Cycle Using SSM/I Channel Ratios," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 43, No. 6, pp. 1317-1323, 2005.

H.S. Anderson and D.G. Long, "Sea Ice Mapping Method for SeaWinds," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 43, No. 3, pp. 647-657, 2005.

I.S. Ashcraft and D.G. Long, "Observation and Characterization of Radar Backscatter over Greenland," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 43, No. 2, pp 237-246, 2005.

I.S. Ashcraft* and D.G. Long, "Observation and Characterization of Radar Backscatter over Greenland," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 43, No. 2, pp 237-246, 2005.

H. Stephen* and D.G. Long, "Microwave Backscatter Modeling of Erg Surfaces in the Sahara Desert," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 43, No. 2, pp. 238-247, 2005.

D.G. Long, M.W. Spencer, and E.G. Njoku, "Spatial Resolution and Processing Tradeoffs for HYDROS: Application of Reconstruction and Resolution Enhancement Techniques," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 43, No. 1, pp. 3-12, 2005.

J. Etcheto, E.Dinnat, J. Boutin, A. Camps, J. Miller, S. Contardo, J. Wesson, J.Font, and D.G. Long, "Wind Speed Effect on L-band Brightness Temperature Inferred from EuroSTARRS and WISE 2001 Field Experiments," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 42, No. 10, 2004.

J. Haarpainter, R.T. Tonboe, D.G. Long and M. L. VanWoert, "Automatic Detection and Validity of the Sea Ice Edge: An Application of Enhanced Resolution QuikScat/SeaWinds Data," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 42, No. 7, pp. 1433-1443, 2004.

P.K. Yoho* and D.G. Long, "Correlation and Covariance of Satellite Scatterometer Measurements," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 42, No. 6, pp. 1176-1187, 2004.

D.W. Draper* and D.G. Long, "Simultaneous Wind and Rain Retrieval Using SeaWinds Data," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 42, No. 7, pp. 1411-1423, 2004.

D.W. Draper* and D.G. Long, "Assessing the Quality of SeaWinds Rain Measurements," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 42, No. 7, pp. 1424-1432, 2004.

D.W. Draper* and D.G. Long, "Evaluating the Effect of Rain on SeaWinds Scatterometer Measurements," *Journal of Geophysical Research*, Vol. 109, No. C02005, doi:10.1029/2002JC001741, 2003.

P.K. Yoho* and D.G. Long, "An Improved Scatterometer Simulation Model for Spaceborne Scatterometer Measurements," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 41, No. 11, pp. 2692-2695, 2003.

Q.P. Remund* and D.G. Long, "Large-scale Inverse Ku-band Backscatter Modeling of Sea Ice," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 41, No. 8, pp. 1821-1833, 2003.

D.W. Draper* and D.G. Long, "An Advanced Ambiguity Selection Algorithm for SeaWinds," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 41, No. 3, pp. 538-547, 2003.

M.W. Spencer*, W-Y Tsai, and D.G. Long, "High Resolution Measurements with a Spaceborne Pencil-Beam Scatterometer Using Combined Range/Doppler Discrimination Techniques," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 41, No. 3, pp. 567-581, 2003.

D.W. Draper* and D.G. Long, "An Assessment of SeaWinds on QuikSCAT Wind Retrieval," *Journal of Geophysical Research*, Vol. 107, No. C12, pp. 3212-3226, Dec. 2002.

D.G. Long, Jarom Ballantyne*, and C. Bertoia, "Is the Number of Icebergs Really Increasing?" *EOS, Transactions of the American Geophysical Union*, Vol. 83, No. 42, pp 469 & 474, 15 Oct. 2002.

Y. Zhao, A.K. Liu, and D.G. Long, "Validation of Sea Ice Motion from QuikSCAT with Those from SSM/I and Buoy," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 40, No. 6, pp. 1241-1246, 2002.

B.E. Barrowes* and D.G. Long, "Evaluation of a Compound Probability Model with Tower-Mounted Scatterometer Data," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 40, No.1, pp. 42-49, 2002.

D.G. Long, M.R. Drinkwater, B. Holt, S. Saatchi, and C. Bertoia, "Global Ice and Land Climate Studies Using Scatterometer Image Data," *EOS, Transaction of the American Geophysical Union*, Vol. 82, No. 43, pg. 503, 23 Oct. 2001. Includes *EOS* Electronic Supplement: http://www.agu.org/eos_elec/010126e.html

R.R. Forster, D.G. Long, K.C. Jezek, S.D. Drobot, and M.R. Anderson, "The Onset of Arctic Sea-Ice Snowmelt as Detected with Passive- and Active-microwave Remote Sensing," *Annals of Glaciology*, Vol. 33, pp. 85-93, 2001.

M.R. Drinkwater, D.G. Long, and A.W. Bingham, "Greenland Snow Accumulation Estimates from Scatterometer Data," *Journal of Geophysical Research*, PARCA Special Issue, Vol. 106, No. D24, pp. 33935-33950, 2001.

D.S. Early* and D.G. Long, "Image Reconstruction and Enhanced Resolution Imaging from Irregular Samples," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 39, No. 2, pp. 291-302, 2001.

Q.P. Remund*, D.G. Long, and M.R. Drinkwater, "An Iterative Approach to Multisensor Sea Ice Classification," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 38, No. 4, pp. 1843-1856, 2000.

D.G. Long and M.R. Drinkwater, "Azimuth Variation in Microwave Scatterometer and Radiometer Data Over Antarctica," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 38, No. 4, pp. 1857-1870, 2000.

M.W. Spencer*, C. Wu, and D.G. Long, "Improved Resolution Backscatter Measurements with the SeaWinds Pencil-Beam Scatterometer," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 38, No. 1, pp.89-104, 2000.

J. Zec*, W.L. Jones, and D.G. Long, "NSCAT Normalized Radar Backscattering Coefficient Biases Using Homogenous Land Targets," *Journal of Geophysical Research*, Vol. 184, No. C5, pp. 11557-11568, 1999.

T. Oliphant* and D.G. Long, "Accuracy of Scatterometer-Derived Winds Using the Cramer-Rao Bound," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 37, No. 6, pp. 2642-2652, 1999.

Q.P. Remund* and D.G. Long, "Sea Ice Extent Mapping Using Ku-Band Scatterometer Data," *Journal of Geophysical Research*, Vol. 104, No. C5, pp. 11515-11527, 1999.

A.E. Gonzales* and D.G. Long, "An Assessment of NSCAT Ambiguity Removal," *Journal of Geophysical Research*, Vol. 104, No. C5, pp. 11449-11457, 1999.

D.G. Long and M.R. Drinkwater, "Cryosphere Applications of NSCAT Data," *IEEE Transactions Geoscience and Remote Sensing*, Vol. 37, No. 3, pp. 1671-1684, 1999.

W-Y Tsai, J.E. Graf, C. Winn, J.N. Huddleston, S. Dunbar, M.H. Freilich, F.J. Wentz, D.G. Long, and W.L. Jones, "Post-launch Sensor Verification and Calibration of the NASA Scatterometer," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 37, No. 3, pp. 1517-1542, 1999.

P.J. Johnson* and D.G. Long, "The Probability Density of Spectral Estimates Based on Modified Periodogram Averages," *IEEE Transactions on Signal Processing*, Vol. 47, No. 5, pp. 1255-1261, 1999.

D.G. Long, Q.P. Remund*, and D.L. Daum*, "A Cloud-Removal Algorithm for SSM/I Data," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 37, No. 1, pp. 54-62, 1999.

J. Graf, C. Sasaki, C. Winn, W.T. Liu, W. Tsai, M. Freilich and D. Long, "NASA Scatterometer Experiment," *Acta Astronautica*, Vol. 43, No. 7-8, pp. 377-407, 1998.

D.G. Long, and D.L. Daum, "Spatial Resolution Enhancement of SSM/I Data," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 35, No. 2, pp. 407-417, 1998.

D. S. Early* and D.G. Long, "Azimuth Modulation of C-band Scatterometer sigma-0 Over Southern Ocean Sea Ice," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 35, No. 5, pp. 1201-1209, Sept. 1997.

M.W. Spencer*, C. Wu, and D.G. Long, "Tradeoffs in the Design of a Spaceborne Scanning Pencil-beam Scatterometer," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 35, No. 1, pp. 115-126, Jan. 1997.

D.G. Long and M.W. Spencer, "Radar Backscatter Measurement Accuracy for a Spaceborne Pencil-Beam Wind Scatterometer with Transmit Modulation," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 35, No. 1, pp. 102-114, Jan. 1997.

D.G. Long, R.S. Collyer*, R. Reed*, and D.V. Arnold, "Dependence of the Normalized Radar Cross Section of Water Waves on Bragg Wavelength--Wind Speed Sensitivity," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 34, No. 3, pp. 656-666, May 1996.

D.G. Long and G.B. Skouson*, "Calibration of Spaceborne Scatterometers Using Tropical Rainforests," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 34, No. 2, pp. 413-424, Mar. 1996.

P. J. Hardin and D. G. Long, "Integrating Reconstructed Scatterometer and Advanced Very High Resolution Radiometer Data for Tropical Forest Inventory," *Optical Engineering*, Vol. 34, No. 11, pp. 3146-3153, Nov. 1995.

D. G. Long and M.R. Drinkwater, "Greenland Observed at High Resolution by the Seasat-A Scatterometer," *Journal of Glaciology*, Vol. 32, No. 2, pp. 213-230, 1994.

D. G. Long and P. Hardin, "Vegetation Studies of the Amazon Basin Using Enhanced Resolution Seasat Scatterometer Data," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 32, No. 2, pp. 449-460, Mar. 1994.

D. G. Long, "Wind Field Model-Based Estimation of SEASAT Scatterometer Winds," *Journal of Geophysical Research*, Vol. 98, No. C8, pp. 14,651-14,668, 1993.

D. G. Long, P. Hardin, and P. Whiting*, "Resolution Enhancement of Spaceborne Scatterometer Data," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 31, No. 3, pp. 700-715, May 1993.

D. G. Long and D. Arnold, "Observational Research in Air/Sea Interaction," Invited Paper, *Remote Sensing Reviews*, Vol. 8, pp. 189-194, 1993.

F. Naderi, M. H. Freilich, and D. G. Long, "Spaceborne Radar Measurement of Wind Velocity Over the Ocean--An Overview of the NSCAT Scatterometer System," invited paper, *Proceedings of the IEEE*, pp. 850-866, Vol. 79, No. 6, June 1991.

D. G. Long and J. M. Mendel, "Identifiability in Wind Estimation from Wind Scatterometer Measurements," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 29, No. 2, pp. 268-276, 1991.

S. J. Shaffer, R.S. Dunbar, S. V. Hsiao, and D.G. Long, "A Median-Filter-Based Ambiguity Removal Algorithm for NSCAT," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 29, No. 1, pp. 167-174, Jan. 1991.

D. G. Long and J. M. Mendel, "Model-Based Estimation of Wind Fields over the Ocean From Scatterometer Measurements Part I: The Wind Field Model," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 28. No. 2, pp. 349-360, May 1990.

D. G. Long and J. M. Mendel, "Model-Based Estimation of Wind Fields over the Ocean From Scatterometer Measurements Part II: Estimation of the Model Parameters," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 28. No. 2, pp. 361-373, May 1990.

D. G. Long, "Exact Computation of the Unwrapped Phase of a Finite-Length Time Series," *IEEE Transactions on Acoustics, Speech, and Signal Processing*, Vol. 36, No. 11, pp. 1787-1790, Nov. 1988.

D. G. Long, C-Y Chi, and F. K. Li, "The Design of an Onboard Digital Doppler Processor for a Spaceborne Scatterometer," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 26, No. 6, pp. 869-878, Nov. 1988.

C-Y Chi, D. G. Long, and F. K. Li, "Roundoff Noise Analysis for Digital Signal Power Processors Using Welch's Spectrum Estimation," *IEEE Transactions on Acoustics, Speech, and Signal Processing*, Vol. ASSP-35, No. 6, June 1987.

C-Y Chi, D. G. Long and F. K. Li, "Radar Backscatter Measurement Accuracies Using Digital Doppler Processors in Spaceborne Scatterometers," *IEEE Transactions on Geoscience and Remote Sensing*, Vol. GE-24, No. 3, May 1986.

## ***Book Chapters***

D.G. Long, "Reconstruction and Resolution Enhancement Techniques for Microwave Sensors," in C.H. Chen (ed.), *Frontiers of Remote Sensing Information Processing*, World Scientific Publishing Co., 2003.

D.P. Winebrenner, D. G. Long, and B. Holt, "Automatable Observation of Seasonal Transitions on Arctic Sea Ice Using Synthetic Aperture Radar," in C. Tsatsoulis and R. Kwok (eds), *Recent Advances in the Analysis of SAR for Studies in the Polar Oceans*, Springer-Verlager, pgs. 129-144, 1998.

D.W. Parry, D.V. Arnold, D.G. Long, S.R. Woodward, "The Dead Sea Scrolls and New Technological Advances: DNA, Electronic Database, and Imaging Radar," for P.W. Flint and J.C. Vanderkam (eds.), *The Dead Sea Scrolls Jubilee Collection*, E.J. Brill, Vol. 1, pg. 496-515, 1998.

*Curriculum Vitae*

**Thomas Reichler**

Assistant Professor
Department of Meteorology
University of Utah
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September 18, 2007

## PROFESSIONAL EXPERIENCE

| | |
|---|---|
| 2004-date | Assistant Professor, Department of Meteorology, University of Utah, UT. |
| 2003-2004 | Visiting Scientist, Geophysical Fluid Dynamics Laboratory, Princeton, NJ. |
| 1997-2003 | Research Assistant, Scripps Institution of Oceanography, La Jolla, CA. |
| 1996-1997 | Research Assistant, Department of Atmospheric Sciences, Univ. of Illinois, IL. |
| 1995-1996 | Research Assistant, Institute for Atmospheric Physics, German Aerospace Center (DLR), Germany. |
| 1993 | Intern, German Remote Sensing Center (DFD), Oberpfaffenhofen, Germany. |
| 1992 | Intern, German Weather Service (DWD), Munich, Germany. |

## EDUCATION

| | |
|---|---|
| 2003 | Ph.D. Oceanography, Scripps Institution of Oceanography, University of California, San Diego. |
| 1996 | M.S. (equivalent), Meteorology, University of Munich; Physical Geography, University of Augsburg, Germany. |

## TEACHING

| | |
|---|---|
| 2005-2007 | Earth Climate System (METEO 6030), University of Utah. |
| 2004-2007 | Atmospheric Dynamics (METEO 6010), University of Utah. |
| 2006 | Case Studies in Computational Engineering (MATH 6790), "Numerical modeling of geophysical flow", University of Utah. |
| 2008 | Advanced Large Scale Dynamics (METEO 6210), planned. |
| 2006 | Graduate Seminar (METEO 7810). |
| 2004-date | Graduate Coordinator, University of Utah. |
| 1998 | Teaching Assistant, Introduction to Atmospheric Sciences (ES20), University of California. |

## STUDENT MENTORING

*Graduate Students Supervised*

Junsu Kim, Ph.D. candidate (2004-date)
Byoung-Cheol Kim, M.S. candidate (2005)
Paul Staten, Ph.D. candidate (2006-date)
Chris Pennell, Ph.D. candidate (2006-date)

*Graduate Committees*

Kantave Green, M.S. (2005-2006).

## PROFESSIONAL SERVICE AND ACTIVITIES

*Reviewer for*

National Science Foundation
National Oceanic and Atmospheric Administration
Journal of Climate
Journal of the Atmospheric Sciences
Quarterly Journal of the Royal Meteorological Society
Journal of Geophysical Research
Geophysical Research Letters
Tellus-A
Atmospheric Science Letter

*Member of*

American Meteorological Society (1997-date)
American Geophysical Union (1997-date)
Royal Meteorological Society (2003-date)

## UNIVERSITY SERVICE AND ACTIVITIES

| | |
|---|---|
| 2004-date | Department of Meteorology Graduate Coordinator. |
| 2004-date | Department of Meteorology Representative to University's Graduate Director's meetings. |
| 2005-2006 | Department of Meteorology Member Representative to the University Corporation for Atmospheric Research. |
| 2005-date | Computational, Engineering and Science (CES) Steering Committee. |
| 2004-2006 | College of Mines and Earth Sciences McGregor Library Committee. |
| 2005-date | College of Mines and Earth Sciences Computer Committee. |
| 2005-date | University of Utah Credits and Admissions Committee. |

## RESEARCH AND EDUCATIONAL SUPPORT

*Current*

"Structural changes in the tropical Hadley circulation: Past and future trends ", Thomas Reichler (Sole PI), NSF, $173,453, 12/05-11/07.

"Predictability of the Arctic oscillation from stratospheric coupling", Thomas Reichler (PI) and Arun Kumar (NCEP/NOAA), NOAA, $376,076 (Univ. of Utah portion $376,076), 6/06-5/09.

"Purchase of a rotating tank for classroom demonstrations", Thomas Reichler (Sole PI), University of Utah Teaching Grant, $3,000, 1/07-4/07.

"Measuring the global tropopause by satellite: uncertainties, structure, and variability", Thomas Reichler (PI), NASA Earth and Space Science Fellowship for Paul Staten, $24,000, 9/07-8/08.

## HONORS AND AWARDS

| | |
|---|---|
| 2003-2004 | Visiting scientist fellowship, GFDL, Princeton, NJ. |
| 1998, 1997 | AMS graduate student fellowship, annual AMS meeting. |
| 1996 | Thesis award, University of Augsburg, Germany (DM 3,000.-) |
| 1978 | Stiftung Jugend forscht (youth science foundation), 1st prize awarded. |

## PUBLICATIONS

*Articles in preparation*

Reichler, T., I. Held, and. K. Rosenlof (2007): Direct observational evidence for a widening of the tropical Hadley cell. *J. Clim.*

Reichler, T. and J. Kim (2007): Validating the present-day mean climate simulated by the IPCC AR4 models. *J. Clim.*

*Submitted Articles*

Seidel, D., Q. Fu, R. Randel, and T. Reichler (2007): Getting wider around the middle: Tropical belt is expanding as climate changes, *Nature-Geosciences*, (sub judice).

Reichler, T. and J. Kim (2007): How well do coupled models simulate present-day climate? A comparison of three generations of coupled models. *Bull. Amer. Meteor. Soc.*, (sub judice).

Reichler, T. and J. Kim (2007): Uncertainties in the climate mean state of global observations, reanalyses, and a modern climate model, *J. Geophys. Res.* (sub judice).

*Refereed Articles*

Lu, J., G. Vecchi, and T. Reichler (2007): Correction to "Expansion of the Hadley cell under global warming". *Geophys. Res. Lett.*, **34** (14), L14808.

Lu, J., G. Vecchi, and T. Reichler (2007): Expansion of the Hadley cell under global warming. *Geophys. Res. Lett.*, **34**, L06805.

Fu, Q., C. Johanson, J. Wallace, and T. Reichler (2006): Enhanced midlatitude tropospheric warming in satellite measurements. *Science,* **312**, 1179.

Reichler, T. and J. O. Roads (2005): Long-range predictability in the tropics. Part I: monthly averages. *J. Climate,* **18**, 619-633.

Reichler, T. and J. O. Roads (2005): Long-range predictability in the tropics. Part II: 30-60 days variability, *J. Climate*, **18**, 634-650.

Reichler, T., P. J. Kushner, and L. M. Polvani (2005): The coupled stratosphere-troposphere response to impulsive forcing from the troposphere, *J. Atmos. Sci.*, **62** (9), 3337–3352.

Reichler, T. and J. O. Roads (2004): Time-space distribution of long-range atmospheric predictability. *J. Atmos. Sci.*, **61**, 249-263.

Reichler, T., M. Dameris, and R. Sausen (2003): Determination of tropopause heights from gridded data. *Geophys. Res. Lett.*, **30**, No. 20, 2042, doi: 10.1029/2003GL018240.

Roads, J., R. Lawford, E. Bainto, H. Berbery, B. Fekete, K. Gallo, A. Grundstein, W. Higgins, J. Janowiak, M. Kanamitsu, V. Lakshmi, D. Leathers, D. Lettenmaier, Q. Li, L. Luo, E. Maurer, T. Meyers, D. Miller, K. Mitchell, T. Mote, R. Pinker, T. Reichler, D. Robinson, A. Robock, J. Smith, G. Srinivasan, K. Vinnikov, T. von der Haar, C. Vorosmarty, S. Williams, and E. Yarosh (2002): GCIP Water and Energy Budget Synthesis (WEBS). *J. Geophys. Res.*, **108**, No. D16, 8609, doi:10.1029/2002JD002583.

Reichler, T. J. and J. O. Roads (2002): The role of boundary and initial conditions for dynamical seasonal predictability. *Nonlinear Processes in Geophysics,* **10**, 211.

*Reports*

Roads, J., R. Lawford, E. Bainto, H. Berbery, B. Fekete, K. Gallo, A. Grundstein, W. Higgins, J. Janowiak, M. Kanamitsu, V. Lakshmi, D. Leathers, D. Lettenmaier, Q. Li, L. Luo, E. Maurer, T. Meyers, D. Miller, K. Mitchell, T. Mote, R. Pinker, T. Reichler, D. Robinson, A. Robock, J. Smith, G. Srinivasan, K. Vinnikov, T. von der Haar, C. Vorosmarty, S. Williams, E. Yarosh, 2002: GCIP Water and Energy Budget Synthesis (WEBS). CD-ROM (available from GAPP program office).

Reichler, T. J., and J. O. Roads (2002): The Impact of Initial Conditions on the Time-Space Distribution of Long-Term Atmospheric Predictability, *Maui High Performance Computing Center, Application Briefs 2001*, Kihei, Hawaii.

Reichler, T. J., and J. O. Roads (2001): The Role of Initial and Boundary Conditions for Dynamical Seasonal Forecasting, *Maui High Performance Computing Center, Application Briefs 2001*, Kihei, Hawaii.

Schlesinger, M. E., N. G. Andronova, A. Ghanem, S. Malyshev, T. J. Reichler, E. Rozanov, W. Wang, and F. Yang (1997): Geographical Scenarios of Greenhouse-Gas and Anthropogenic-Sulfate-Aerosol Induced Climate Changes.

Reichler, T. J., M. Dameris, R. Sausen and D. Nodorp (1996): A global climatology of the tropopause height based on ECMWF-analyses, DLR Oberpfaffenhofen, Institute of Atmospheric Physics, 57, ISSN 0943-4771, 23 pp.

*Proceedings and Talks*

Reichler, T., J. Kim, and A. Kumar (2007): Short-term climate predictability associated with stratospheric influences in operational forecast systems. AGU Chapman conference on The Role of the Stratosphere in Climate and Climate Change, Santorini, Greece, September 24-28, 2007, (invited talk).

Reichler, T. and J. Kim (2007): How well do coupled models simulate present-day climate? *3rd WGNE Workshop on Systematic Errors in Climate and NWP Models*, San Francisco (CA), February 12-16, 2007, (poster).

Reichler, T., J. Lu, G. A. Vecchi, Q. Fu (2006): Expansion of the Hadley Cell: A Possible New Driver for Droughts? *American Geophysical Union Fall Meeting*, San Francisco (CA), December 14, (poster).

Reichler, T. and J. Kim (2006): How well do coupled models simulate present-day climate? *American Geophysical Union Fall Meeting*, San Francisco (CA), December 14, (poster).

Lu, J., G. Vecchi, and T. Reichler (2006): Expansion of the Hadley cell under global warming. *NOAA 31st Climate Diagnostics & Prediction Workshop*, Boulder (CO), October 25, (poster).

Reichler, T. and J. Kim (2006): How well do coupled models simulate present-day climate? *National Center for Atmospheric Research*, Boulder (CO), October 12, (seminar).

Reichler, T. and J. Kim (2006): How well do coupled models simulate present-day climate? *National Oceanographic & Atmospheric Association - Earth System Research Laboratory*, Boulder (CO), October 12, (seminar).

Reichler, T. and J. Kim (2006): How well do coupled models simulate present-day climate? A comparison of three generations of models. *Geophysical Fluid Dynamics Laboratory*, Princeton (NJ), August 14, (invited seminar).

Reichler, T. and J. Kim (2006): How well do coupled models simulate present-day climate? A comparison of three generations of models. *Goddard Institute for Space Studies*, New York (NY), August 15, (seminar).

Reichler, T. (2006): Climate change: Theory – Facts – Uncertainties. Invited guest lecture at the *University of Utah*, Department of Philosophy, April 11.

Reichler, T., and I. Held (2005): A possible widening of the tropical Hadley cell over the past decades, *AGU fall meeting*, Global Environmental Change session, December, (talk).

Kim, J., and T. Reichler (2005): A Performance Index for the Evaluation of Coupled Climate Models, *AGU fall meeting*, Global Environmental Change session, December, (poster).

Kim, J., and T. Reichler (2005): How well do models simulate observations? A critical appraisal of the latest generation of coupled climate models, *Department of Meteorology, University of Utah*, Salt Lake City, November, (seminar).

Reichler, T. (2005): An introduction to three-dimensional climate modeling, *Scientific Computing and Imaging Institute, University of Utah*, Salt Lake City, November, (invited seminar).

Reichler, T., and I. Held (2005): Widening trend of the Hadley cell Over the Past 40 Years, *Conference on Climate Variability and Change*, Cambridge, MA, June, (talk).

Reichler, T., P. J. Kushner, and L. M. Polvani (2005): The coupled stratosphere-troposphere response to impulsive forcing from the troposphere, Conference on Middle Atmosphere, Cambridge, MA, June, (poster).

Kushner, P. J., T. Reichler, and L. M. Polvani (2005): The coupled stratosphere-troposphere response to impulsive forcing from the troposphere, Canadian CLIVAR network meeting, Montreal, February, (talk).

Kushner, P. J., L. M. Polvani, and T. Reichler (2004): Extratropical stratosphere-troposphere dynamical coupling: Perspectives from a simple GCM, *AGU fall meeting*, December, (talk).

Reichler, T., I. Held (2004): Evidence for a Widening of the Hadley cell over the past 40 years, *Global Circulation of the Atmosphere*, Pasadena, CA, November, (poster).

Reichler, T. (2004): Long-range atmospheric predictability, *Department of Meteorology, University of Utah*, Salt Lake City, September, (seminar talk).

Reichler, T., P. J. Kushner, and L. M. Polvani (2004): The coupled stratosphere-troposphere response to impulsive forcing from the troposphere, *SPARC general assembly*, Victoria, CA, August, (poster).

Reichler, T., M. Dameris, R. Sausen (2004): Determination of tropopause heights from gridded data, *SPARC general assembly*, Victoria, CA, August, (poster).

Reichler, T., P. J. Kushner, and L. M. Polvani (2004): The coupled stratosphere-troposphere response to impulsive forcing from the troposphere, *Climate Prediction Center, NCEP-NOAA*, Camp Springs, MD, May, (invited seminar).

Reichler, T. (2004): The role of initial and boundary conditions for sub-seasonal predictability, *Global Modeling and Assimilation Office, Goddard Space Flight Center GSFC-NASA*, Greenbelt, MD, May, (invited seminar).

Reichler, T., P. J. Kushner, and L. M. Polvani (2004): The coupled stratosphere-troposphere response to impulsive forcing from the troposphere, *Global Modeling and Assimilation Office, Goddard Space Flight Center GSFC-NASA*, Greenbelt, MD, May, (invited seminar).

Reichler, T., P. J. Kushner, and L. M. Polvani (2004): The coupled stratosphere-troposphere response to impulsive forcing from the troposphere, *IGERT Joint Program in Applied Mathematics and the Earth & Environmental Sciences, Columbia University*, NY, May, (invited seminar).

Reichler, T. (2004): The role of initial and boundary conditions for sub-seasonal predictability, *Center for Ocean-Land-Atmosphere Studies COLA*, Calverton, MD, May, (invited seminar).

Reichler, T., P. J. Kushner, and L. M. Polvani (2004): Response of the stratosphere-troposphere system to impulsive topographic forcing, *EGU 1st General Assembly*, Dynamics of the Middle Atmosphere, Nice, April, (talk).

Reichler, T., and J. O. Roads (2004): The role of initial and boundary conditions for long-range atmospheric predictability, *Lamont-Doherty Earth Observatory*, Palisades, April, (invited seminar).

Reichler, T., P. J. Kushner, and L. M. Polvani (2004): Response of the stratosphere-troposphere system to impulsive forcing, *Atmospherics Physics Group, University of Toronto*, Toronto, March, (invited seminar).

Reichler, T. , P. J. Kushner, and L. M. Polvani (2003): Response of the stratosphere-troposphere system to impulsive forcing, *Geophysical Fluid Dynamics Laboratory*, Princeton, December, (seminar).

Reichler, T. , P. J. Kushner, and L. M. Polvani (2003): The response of the stratosphere-troposphere system to impulsive forcing, *Department of Meteorology, University of Utah*, Salt Lake City, October, (invited seminar).

Reichler, T. J., and J. O. Roads (2003): Predictability of the MJO, *EGS/AGU Joint Assembly*, Intraseasonal and seasonal climate predictability, Nice, April, (talk).

Reichler, T. J., and J. O. Roads (2003): Predictability and sensitivity of monthly means in the tropics, *EGS/AGU Joint Assembly*, Intraseasonal and seasonal climate predictability, Nice, April, (poster).

Reichler, T. J. (2002): Atmospheric Long-Range Predictability, *NOAA/Geophysical Fluid Dynamics Laboratory*, Princeton, NJ, June, (invited seminar).

Reichler, T. J., and J. O. Roads (2002): Atmospheric Long-Range Predictability, *National Institute for Water and Atmosphere*, Wellington, New Zealand, May, (invited seminar).

Reichler, T. J., and J. O. Roads (2002): The role of atmospheric initial conditions for long-range predictability. *Workshop on Prospects for improved Forecasts of Weather and Short-term Climate Variability on Subseasonal Time Scales, NASA/GSFC*, Greenbelt, MD, April, (talk).

Reichler, T. J., J. O. Roads, and M. Kanamitsu (2002): Dynamical Seasonal Predictions: Sensitivity to soil moisture and initial conditions. *82$^{nd}$ AMS annual meeting, 13$^{th}$ symposium on global climate change and climate variations*, Orlando, FL, January, (poster).

Reichler, T. J., J. O. Roads, and M. Kanamitsu (2001): Dynamical Seasonal Predictability. *ECPC meeting, Scripps Institution of Oceanography*, La Jolla, CA, December, (talk).

Reichler, T. J., J. O. Roads, and M. Kanamitsu (2001): The Role of Initial and Boundary Conditions for Dynamical Seasonal Forecasting. *26$^{th}$ Annual Climate Diagnostics and Prediction Workshop, Scripps Institution of Oceanography*, La Jolla, CA, October, (talk).

Reichler, T. J., J. O. Roads, and M. Kanamitsu (2001): The Role of Initial and Boundary Conditions for Dynamical Seasonal Forecasting. *ARCs network meeting, Scripps Institution of Oceanography*, La Jolla, CA, October, (talk).

Reichler, T. J., J. O. Roads, and M. Kanamitsu (2001): Seasonal Climate Predictability in a General Circulation Model. *European Geophysical Society XXVI General Assembly*, Nice, France, March, (talk).

Gershunov, A., T. J. Reichler and J. O. Roads (2001): Sources of Seasonal Predictability for Daily Precipitation Extreme Statistics Over the Eastern US, *AAG meeting 2001* (Association of American Geographers), NY March 3, (poster).

Gershunov, A., D. Cayan, T. J. Reichler and J. O. Roads (2001): Seasonal Predictability of Regional Hydrometeorology, *European Geophysical Society XXVI General Assembly*, Nice, France, (poster).

Reichler, T. J., J. O. Roads, and M. Kanamitsu (2001): The Role of Ocean Boundary Conditions for Seasonal Predictability, *Proceedings to the Symposium on Climate Variability, the Oceans and Societal Impacts*, Albuquerque, New Mexico, (poster).

Gershunov, A., T. J. Reichler, and J. O. Roads (2001): Sources of Seasonal Predictability for Daily Precipitation Extreme Statistics Over the Eastern US, *Proceedings to the Symposium on Climate Variability, the Oceans and Societal Impacts*, Albuquerque, New Mexico, (talk).

Reichler, T. J., J. O. Roads, and M. Kanamitsu (2000): Seasonal Predictability Studies with the NCEP Global Spectral Model. *ECPC meeting, Scripps Institution of Oceanography*, La Jolla, CA, December, (talk).

Reichler, T. J., J. O. Roads, and M. Kanamitsu (2000): Validation of the NCEP Global Spectral Model. *2nd international RSM workshop*, Maui, HI, July, (talk).

Reichler, T. J., J. O. Roads and S. Chen (2000): Seasonal predictions with the NCEP reanalysis-2 model: Initial value or boundary forced?" *ARCs/IRI meeting, Lamont-Doherty Earth Observatory*, Palisades, NY, March, (talk).

Roads, J. O., T. J. Reichler, S. Chen, M. Kanamitsu, and W. Ebisuzaki (1999): Surface water characteristics and influences in NCEP/DOE Reanalysis II. *Proceedings of the 2nd International Conference on Reanalysis*, Wokefield Park, United Kingdom, Aug. 23-27, (talk).

Chen, S., T. J. Reichler, and J. O. Roads, (1999): The NCEP reanalysis II model: Surface forcing characteristics and SST-sensitivity. *CORC Pacific Meeting, Scripps Institution of Oceanography*, La Jolla, CA, August, (talk).

Reichler, T. J., J. O. Roads, and M. Kanamitsu (1999): The NCEP reanalysis II model: Climatology, variability and SST sensitivity. *Workshop on extratropical SST anomalies, Climate Diagnostics Center*, Boulder, CO, June, (talk).

Reichler, T. J., J. O. Roads, M. Kanamitsu, S. Chen, and D. Cayan (1998): Surface fluxes in the NCEP/NCAR reanalysis GSM climate model and COADS. *CORC Pacific Meeting, University of California – San Diego*, La Jolla, CA, October, (talk).